(19)日本国特許庁（ＪＰ）　(12)特　許　公　報（Ｂ２）　(11)特許番号
特許第3366401号
(P3366401)

(45)発行日　平成15年１月14日(2003.1.14)　(24)登録日　平成14年11月１日(2002.11.1)

(51)Int.Cl.⁷	識別記号	ＦＩ	
Ｃ０９Ｋ　11/06	６１０	Ｃ０９Ｋ　11/06	６１０
Ｈ０５Ｂ　33/14		Ｈ０５Ｂ　33/14	

請求項の数12(全 48 頁)

(21)出願番号　特願平5－290207

(22)出願日　平成５年11月19日(1993.11.19)

(65)公開番号　特開平6－207170
(43)公開日　平成６年７月26日(1994.7.26)
審査請求日　平成９年５月13日(1997.5.13)
審判番号　不服2000－4789(P2000－4789/J1)
審判請求日　平成12年３月１日(2000.3.1)
(31)優先権主張番号　特願平4－311889
(32)優先日　平成４年11月20日(1992.11.20)
(33)優先権主張国　日本（ＪＰ）

(73)特許権者　000183646
出光興産株式会社
東京都千代田区丸の内３丁目１番１号
(72)発明者　松浦　正英
千葉県袖ケ浦市上泉1280番地　出光興産株式会社内
(72)発明者　東海林　弘
千葉県袖ケ浦市上泉1280番地　出光興産株式会社内
(74)代理人　100078732
弁理士　大谷　保

合議体
審判長　板橋　一隆
審判官　後藤　圭次
審判官　井上　彌一

最終頁に続く

(54)【発明の名称】　白色有機エレクトロルミネッセンス素子

1

(57)【特許請求の範囲】
【請求項１】　少なくとも一方が透明もしくは半透明な一対の電極間に発光層を少なくとも含む有機化合物層を挟持してなる有機エレクトロルミネッセンス素子において、該発光層は固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物を含有する第一発光層と、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物を含有する第二発光層とが透明電極又は陽極側から順次積層された積層構造からなり、かつ溶液状態での蛍光ピーク波長が５８０ｎｍ以上６５０ｎｍ以下である有機化合物を、上記第一発光層、第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に、その層を形成する有機化合物に対し、０.１～１０モル％の割合で含有させたことを特徴とする白色有機エレクトロルミネッセンス素子。

2

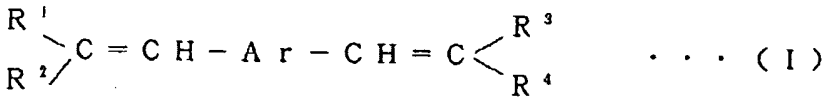
【請求項２】　少なくとも一方が透明もしくは半透明な一対の電極間に発光層を少なくとも含む有機化合物層を挟持してなる有機エレクトロルミネッセンス素子において、該発光層は固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物を含有する第一発光層と、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物を含有する第二発光層とが透明電極又は陽極側から順次積層された積層構造からなり、ルモゲンＦレッド、ジシアノメチレンピラン、フェノキゾサン、ルブレン、ジシアノメチレンピラン誘導体、ジシアノメチレンチオピラン誘導体、フルオレセイン誘導体及びペリレン誘導体の中から選ばれる少なくとも一種類の有機化合物を、上記第一発光層、第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に、その層を形成する有機化合物に対し、０.１～１

０モル％の割合で含有させたことを特徴とする白色有機エレクトロルミネッセンス素子。

【請求項３】　少なくとも一方が透明もしくは半透明な一対の電極間に発光層を少なくとも含む有機化合物層を挟持してなる有機エレクトロルミネッセンス素子において、該発光層は固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物を含有する第一発光層と、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物を含有する第二発光層とが透明電極又は陽極側から順次積層された積層構造からなり、かつ溶液状態の蛍光が赤色系である有機化合物を、上記第一発光層、第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に、その層を形成する有機化合物に対し、０．１～１０モル％の割合で含有させたことを特徴とする白色有機エレクトロルミネッセンス素子。

【請求項４】　固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物が、一般式（Ｉ）

【化１】



・・・（Ｉ）

〔式中、Ｒ１～Ｒ４は、それぞれ水素原子，炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，置換もしくは無置換の炭素数６～１８のアリール基，置換もしくは無置換の芳香族複素環式基，置換もしくは無置換のシクロヘキシル基，置換もしくは無置換の炭素数６～１８のアリールオキシ基を示す。ここで、置換基は炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，炭素数６～１８のアリールオキシ基，炭素数１～６のアシル基，炭素数１～６のアシルオキシ基，カルボキシル基，スチリル基，炭素数６～２０のアリールカルボニル基，炭素数６～２０のアリールオキシカルボニル基，炭素数１～６のアルコキシカルボニル基，ビニル基，アニリノカルボニル基，カルバモイル基，フェニル基，ニトロ基，水酸基あるいはハロゲン原子を示す。これらの置換基は単一でも複数でもよい。また、Ｒ１～Ｒ４は同一でも、また互いに異なっていてもよく、Ｒ１とＲ２及びＲ３とＲ４は互いに置換している基と結合して、置換もしくは無置換の飽和又は不飽和の五員環あるいは置換もしくは無置換の飽和又は不飽和の六員環を形成してもよい。Ａｒは置換もしくは無置換の炭素数６～２０のアリーレン基を表わし、単一置換されていても、複数置換されていてもよく、また結合部位は、オルト，パラ，メタいずれでもよい。なお、置換基は前記と同じである。また、アリーレン基の置換基同士が結合して、置換もしくは無置換の飽和又は不飽和の五員環あるいは置換もしくは無置換の飽和又は不飽和の六員環を形成してもよい。但し、Ａｒが無置換フェニレンの場合、Ｒ１～Ｒ４はそれぞれ炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，置換もしくは無置換のナフチル基，ビフェニル基，シクロヘキシル基，アリールオキシ基より選ばれたものである。〕

で表される芳香族メチリディン化合物である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項５】　固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物が、一般式（II）

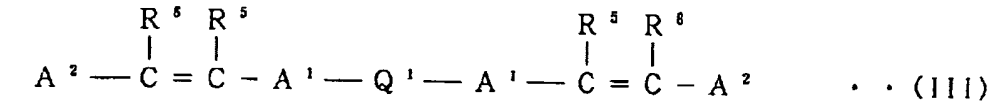
Ａ－Ｑ－Ｂ　　・・・（II）

〔式中、Ａ及びＢは、それぞれ上記一般式（Ｉ）で表される化合物から１つの水素原子を除いた一価基を示し、同一であっても異なってもよい。また、Ｑは共役系を切る二価基を示す。〕

で表される芳香族メチリディン化合物である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項６】　固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物が、一般式（III）

【化２】



・・（III）

〔式中、Ａ1は置換もしくは無置換の炭素数６～２０のアリーレン基又は二価の芳香族複素環式基を示す。結合位置はオルト，メタ，パラのいずれでもよい。Ａ2は置換もしくは無置換の炭素数６～２０のアリール基又は一価の芳香族複素環式基を示す。Ｒ５及びＲ６は、それぞれ水素原子，置換もしくは無置換の炭素数６～２０のアリール基，シクロヘキシル基，一価の芳香族複素環式基，炭素数１～１０のアルキル基，炭素数７～２０のアラルキル基又は炭素数１～１０のアルコキシ基を示す。なお、Ｒ５，Ｒ６は同一でも異なってもよい。ここで、置換基とは、アルキル基，アリールオキシ基，アミノ基又はこれらの基を有するもしくは有しないフェニル基であり、該置換基は単一でも複数でもよい。また、Ｒ５の各置換基はＡ1と結合して、飽和もしくは不飽和の五員環又は六員環を形成してもよく、同様にＲ６の各置換基はＡ2と結合して、飽和もしくは不飽和の五員環又は六

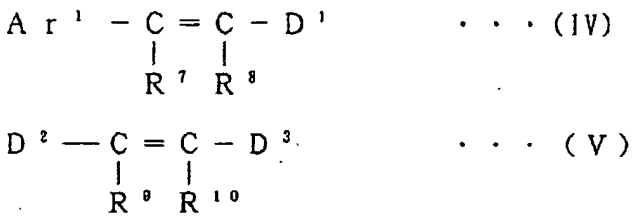
5

員環を形成してもよい。また、Q1 は、共役を切る二価基を表す。〕
で表される芳香族メチリディン化合物である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項７】　固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物が、８－ヒドロキシキノリンまたはその誘導体の金属錯体である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項８】　第一発光層及び／又は第二発光層に、一般式（IV）及び（V）

【化３】



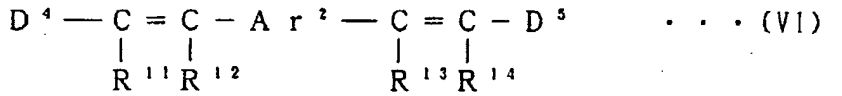
・・・（IV）

・・・（V）

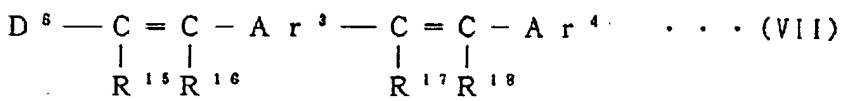
〔式中、Ａｒ1 は炭素数６～２０のアリール基を示す。R7 ～R10は、それぞれ独立に水素原子又は炭素数６～２０のアリール基を示す。D1 ～D3 は、それぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。ここで、Ａｒ1 ，R7 ～R10は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基，炭素数６～１０のアラルキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。〕
で表されるスチルベン誘導体の中から選ばれた少なくとも一種を含有させてなる請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項９】　第一発光層及び／又は第二発光層に、一般式（VI）及び(VII)

【化４】



・・・(VI)

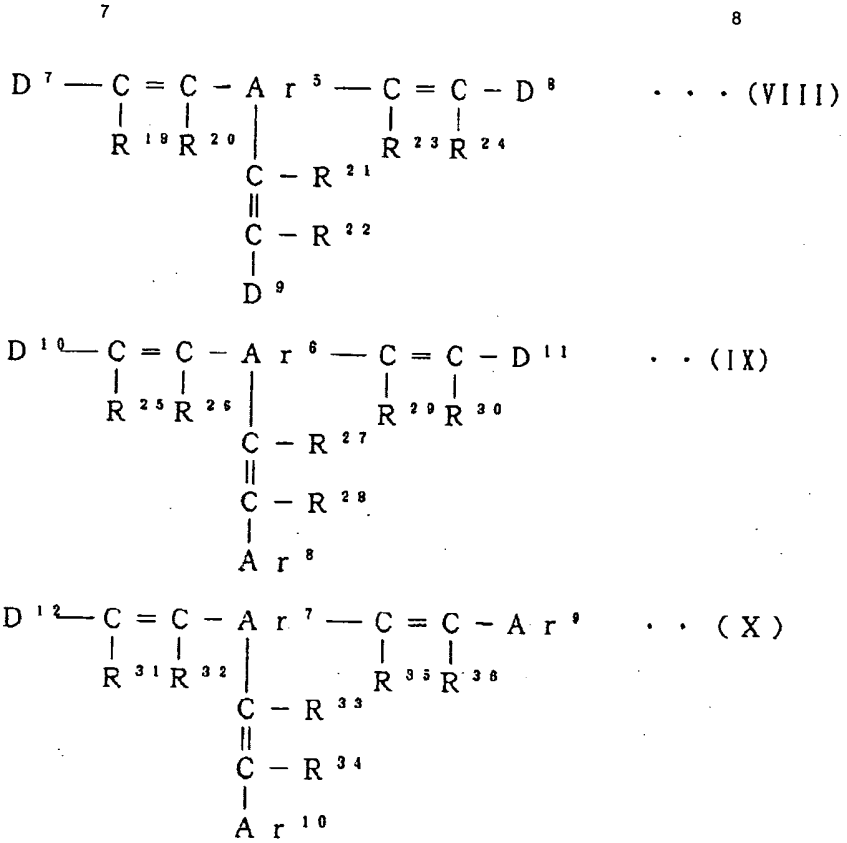


・・・(VII)

〔式中、Ａｒ2 及びＡｒ3 は、それぞれ独立に炭素数６～２０のアリーレン基を示し、Ａｒ4 は炭素数６～２０のアリール基を示す。R11～R18は、それぞれ独立に水素原子又は炭素数６～２０のアリール基を示す。ここで、Ａｒ2 ～Ａｒ4，R11～R18は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基，炭素数６～１０のアラリキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。D4 ～D6 は、それぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。〕で表されるジスチルアリーレン誘導体の中から選ばれた少なくとも一種を含有させてなる請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項１０】　第一発光層及び／又は第二発光層に、一般式（VIII）～（X）

【化５】



〔式中、Ａｒ5 ～Ａｒ7 は、それぞれ独立に炭素数６～２４の３価の芳香族環基を示し、Ａｒ8 ～Ａｒ10は、それぞれ独立に炭素数６～２０のアリール基を示す。Ｒ19～Ｒ36は、それぞれ独立に水素原子又は炭素数６～２０のアリール基を示す。Ｄ7 ～Ｄ12はそれぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。ここで、Ａｒ5 ～Ａｒ7，Ｒ19～Ｒ36は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基，炭素数６～１０のアラルキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。〕で表されるトリススチリルアリーレン誘導体の中から選ばれた少なくとも一種を含有させてなる請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項１１】　第一発光層と第二発光層において、陰極側に近い発光層の方が、電子輸送能力が大である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【請求項１２】　第二発光層の膜厚が、第一発光層の膜厚以上である請求項１～３のいずれかに記載の白色有機エレクトロルミネッセンス素子。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は新規な白色有機エレクトロルミネッセンス素子に関し、さらに詳しくは、発光効率が高く、かつ発光安定性に優れた白色発光を呈する有機エレクトロルミネッセンス素子に関するものである。

【０００２】

【従来の技術】エレクトロルミネッセンス素子（ＥＬ素子）は、自己発光のため視認性が高く、かつ完全固体素子であるため、耐衝撃性に優れるという特徴を有している。そのため、現在、無機又は有機化合物を用いた様々なＥＬ素子が提案され、かつ、実用化が試みられている。これらの素子のうち、有機ＥＬ素子は印加電圧を大幅に低下させることができるので、各種材料・素子の開発が進められている。さらに、現在用いられているバックライトやディスプレイなどの表示素子の軽量化にも有効である。白色発光する有機ＥＬ素子については、従来、次のような技術の開示がなされているが、以下のような問題点が多々あった。例えば、ヨーロッパ公開特許第０３９０５５１号公報では、キャリアをキャリア界面の蓄積によるトンネリング注入によって取り込むため白色発光するための域値電圧が存在し、その域値以下においては白色ではないため階調表示ができない。特開平３－２３０５８４号公報では、二色の蛍光物の混合発光であるため良好な白色にはならない。特開平２－２２０３９０号公報では、白色発光を呈するが、印加電圧３０Ｖで輝度１１０ｃｄ／ｍ^2 であり、駆動電圧が高い割りには発光効率が低い。特開平４－５１４９１号公報では、端面発光構造であり面全体としての用途には不適である。

【０００３】

【発明が解決しようとする課題】本発明は、このような事情のもとで、従来の有機ＥＬ素子の特性を維持するとともに、発光効率が高く、かつ発光安定性に優れた白色発光を呈する有機ＥＬ素子を提供することを目的としてなされたものである。

【０００４】

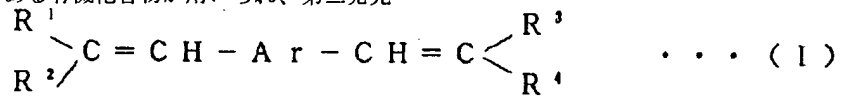
【課題を解決するための手段】本発明者らは、高い発光効率及び発光安定性を有する白色有機ＥＬ素子を開発すべく鋭意研究を重ねた結果、正孔と電子との再結合領域を第一発光層と第二発光層との界面領域として、第一発光層及び第二発光層それぞれに、固体状態の蛍光ピーク波長が異なる特定の範囲にある有機化合物を含有させ、かつ第一発光層、第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に、溶液状態での蛍光ピーク波長が特定の範囲にある有機化合物を含有させることにより、従来の有機ＥＬ素子の特性を維持するとともに、発光効率が高く、かつ発光安定性に優れた白色発光を呈する有機ＥＬ素子が得られることを見出した。本発明は、かかる知見に基づいて完成したものである。すなわち、本発明は、少なくとも一方が透明もしくは半透明な一対の電極間に発光層を少なくとも含む有機化合物層を挟持してなる有機エレクトロルミネッセンス素子において、該発光層は固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満である有機化合物を含有する第一発光層と、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物を含有する第二発光層とが透明電極又は陽極側から順次積層された積層構造からなり、かつ溶液状態での蛍光ピーク波長が５８０ｎｍ以上６５０ｎｍ以下である有機化合物を、上記第一発光層、第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に、その層を形成する有機化合物に対し、０.１～１０モル％の割合で含有させたことを特徴とする白色有機エレクトロルミネッセンス素子を提供するものである。

【０００５】本発明の白色有機ＥＬ素子は、第一発光層と第二発光層の２層の発光層に特徴がある。この第一発光層には、固体状態の蛍光ピーク波長が３８０ｎｍ以上４８０ｎｍ未満（青色系）、好ましくは４２０ｎｍ以上４７５ｎｍ未満である有機化合物が用いられ、第二発光層には、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満（緑色系）、好ましくは４９０ｎｍ以上５６０ｎｍ未満である有機化合物が用いられる。さらに、上記発光層及び他の有機化合物層の中から選ばれた少なくとも一層に、溶液状態での蛍光ピーク波長が５８０ｎｍ以上６５０ｎｍ以下（赤色系）、好ましくは５８５ｎｍ以上６２０ｎｍ以下である有機化合物を、その層を形成する有機化合物に対して０.１～１０モル％、好ましくは０.５～５モル％の割合で含有させたことを特徴とする。この０.１～１０モル％というのは、濃度消光を生じないための濃度範囲である。なお、蛍光スペクトルにおいて、ピークが複数ある化合物においては、上記のそれぞれの波長全面域に少なくとも一つのピークをもっていればよい。

【０００６】本発明の白色有機ＥＬ素子による白色光は、上記第一発光層及び第二発光層及び混合成分からの発光の重ね合わせ（すなわち、特定の蛍光ピーク波長を有する３種類の上記有機化合物の３原色発光の重ね合わせ）により得ることができる。なお、図１に白色光の定義をＣＩＥ座標にて示した。ここで、第一発光層に用いる有機化合物は、特に限定されず、例えば特開平３－２３１９７０号公報あるいは国際公開特許ＷＯ９２／０５１３１号公報、特願平５－１７０３５４号明細書、特願平５－１２９４３８号明細書に記載されている有機化合物の中で、上記第一発光層の蛍光条件を満足するものが挙げられる。好ましいものとしては、特開平３－２３１９７０号公報、国際公開特許ＷＯ９２／０５１３１号公報、特願平５－１７０３４５号明細書に記載されている上記第一発光層の蛍光条件を満たすものと、特願平５－１２９４３８号明細書に記載されている適当な化合物との組合せ、さらには後述する正孔注入輸送層に用いる化合物のなかで、上記第一発光層の蛍光条件を満足するものを挙げることができる。次に、特開平３－２３１９７０号公報、国際公開特許ＷＯ９２／０５１３１号公報に記載されている上記第一発光層の蛍光条件を満たす化合物としては、一般式（Ｉ）

【０００７】

【化６】



・・・（Ｉ）

【０００８】〔式中、R^1～R^4は、それぞれ水素原子，炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，置換もしくは無置換の炭素数６～１８のアリール基，置換もしくは無置換の芳香族複素環式基，置換もしくは無置換のシクロヘキシル基，置換もしくは無置換の炭素数６～１８のアリールオキシ基，置換もしくは無置換のピリジル基を示す。ここで、置換基は炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，炭素数６～１８のアリールオキシ基，炭素数１～６のアシル基，炭素数１～６のアシルオキシ基，カルボキシル基，スチリル基，炭素数６～２０のアリールカルボニル基，炭素数６～２０のアリールオキシカルボニル基，炭素数１～６のアルコキシカルボニル基，ビニル基，アニリノカルボニル基，カルバモイル基，フェニル基，ニトロ基，水酸基あるいはハロゲン原子を示す。こ

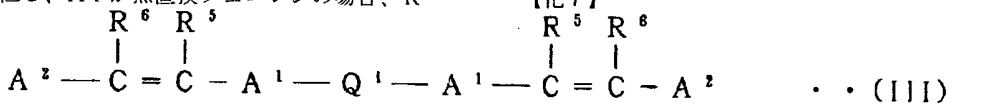
れらの置換基は単一でも複数でもよい。また、R^1～R^4は同一でも、また互いに異なっていてもよく、R^1とR^2及びR^3とR^4は互いに置換している基と結合して、置換もしくは無置換の飽和又は不飽和の五員環あるいは置換もしくは無置換の飽和又は不飽和の六員環を形成してもよい。Ａｒは置換もしくは無置換の炭素数６～２０のアリーレン基を表わし、単一置換されていても、複数置換されていてもよく、また結合部位は、オルト，パラ，メタいずれでもよい。なお、置換基は前記と同じである。また、アリーレン基の置換基同士が結合して、置換もしくは無置換の飽和又は不飽和の五員環あるいは置換もしくは無置換の飽和又は不飽和の六員環を形成してもよい。但し、Ａｒが無置換フェニレンの場合、R^1～R^4は、それぞれ炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，置換もしくは無置換のナフチル基，ビフェニル基，シクロヘキシル基，アリールオキシ基より選ばれたものである。〕で表される芳香族メチリディン化合物，一般式（II）

Ａ－Ｑ－Ｂ　　・・・　（II）

〔式中、Ａ及びＢは、それぞれ上記一般式（Ｉ）で表される化合物から１つの水素原子を除いた一価基を示し、同一であっても異なってもよい。また、Ｑは共役系を切る二価基を示す。〕で表される芳香族メチリディン化合物及び一般式（III）

【０００９】

【化７】



・・（III）

【００１０】〔式中、A^1は置換もしくは無置換の炭素数６～２０のアリーレン基又は二価の芳香族複素環式基を示す。結合位置はオルト，メタ，パラのいずれでもよい。A^2は置換もしくは無置換の炭素数６～２０のアリール基又は一価の芳香族複素環式基を示す。R^5及びR^6は、それぞれ水素原子，置換もしくは無置換の炭素数６～２０のアリール基，シクロヘキシル基，一価の芳香族複素環式基，炭素数１～１０のアルキル基，炭素数７～２０のアラルキル基又は炭素数１～１０のアルコキシ基を示す。なお、R^5，R^6は同一でも異なってもよい。ここで、置換基とは、アルキル基，アリールオキシ基，アミノ基又はこれらの基を有するもしくは有しないフェニル基であり、該置換基は単一でも複数でもよい。R^5の各置換基はA^1と結合して、飽和もしくは不飽和の五員環又は六員環を形成してもよく、同様にR^6の各置換基はA^2と結合して、飽和もしくは不飽和の五員環又は六員環を形成してもよい。また、Q^1は前記と同じである。〕で表される芳香族メチリディン化合物が挙げられる。

【００１１】ここで、一般式（Ｉ）中のR^1～R^4は、前述の如く同一でも異なってもよく、それぞれ水素原子，炭素数１～６のアルキル基（メチル基，エチル基，ｎ－プロピル基，イソプロピル基，ｎ－ブチル基，イソブチル基，sec －ブチル基，tert－ブチル基，イソペンチル基，t-ペンチル基，ネオペンチル基，イソヘキシル基），炭素数１～６のアルコキシ基（メトキシ基，エトキシ基，プロポキシ基，ブトキシ基等），炭素数７～１８のアラルキル基（ベンジル基，フェネチル基等），炭素数６～１８のアリール基（フェニル基，ビフェニル基，ナフチル基等），シクロヘキシル基，芳香族複素環式基（ピリジル基，キノリル基），炭素数６～１８のアリールオキシ基（フェノキシ基，ビフェニルオキシ基，ナフチルオキシ基等）を示す。

【００１２】また、R^1～R^4は、これらに置換基の結合したものでもよい。即ち、R^1～R^4は、それぞれ置換基含有フェニル基，置換基含有アラルキル基，置換基含有シクロヘキシル基，置換基含有ビフェニル基，置換基含有ナフチル基を示す。ここで、置換基は炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，炭素数６～１８のアリールオキシ基，炭素数１～６のアシル基，炭素数１～６のアシルオキシ基，カルボキシル基，スチリル基，炭素数６～２０のアリールカルボニル基，炭素数６～２０のアリールオキシカルボニル基，炭素数１～６のアルコキシカルボニル基，ビニル基，アニリノカルボニル基，カルバモイル基，フェニル基，ニトロ基，水酸基あるいはハロゲン原子であり、複数置換されていてもよい。したがって、例えば、置換基含有アラルキル基は、アルキル基置換アラルキル基（メチルベンジル基，メチルフェネチル基等），アルコキシ基置換アラルキル基（メトキシベンジル基，エトキシフェネチル基等），アリールオキシ基置換アラルキル基（フェノキシベンジル基，ナフチルオキシフェネチル基等），フェニル基置換アラルキル基（フェニルフェネチル基等）、上記置換基含有フェニル基は、アルキル基置換フェニル基（トリル基，ジメチルフェニル基，エチルフェニル基など），アルコキシ基置換フェニル基（メトキシフェニル基，エトキシフェニル基など）アリールオキシ基置換フェニル基（フェノキシフェニル基，ナフチルオキシフェニル基等）あるいはフェニル基置換フェニル基（つまり、ビフェニリル基）である。また、置換基含有シクロヘキシル基は、アルキル基置換シクロヘキシル基（メチルシクロヘキシル基，ジメチルシクロヘキシル基，エチルシクロヘキシル基等），アルコキシ基置換シクロヘキシル基（メトキシシクロヘキシル基，エトキシシクロヘキシル基等）あるいはアリールオキシ基置換シクロヘキシル基（フェノキシシクロヘキシル基，ナフチルオキシシクロヘキシル基），フェニル基置換シクロヘキシル基（フェニルシク

ロヘキシル基）である。置換基含有ナフチル基は、アルキル基置換ナフチル基（メチルナフチル基，ジメチルナフチル基等），アルコキシ基置換ナフチル基（メトキシナフチル基，エトキシナフチル基等）あるいはアリールオキシ基置換ナフチル基（フェノキシナフチル基，ナフチルオキシナフチル基），フェニル基置換ナフチル基（フェニルナフチル基）である。

【００１３】上記R^1～R^4としては、上述したもののうち、それぞれ炭素数１～６のアルキル基，アリールオキシ基，フェニル基，ナフチル基，ビフェニル基，シクロヘキシル基が好ましい。これらは置換あるいは無置換のいずれでもよい。また、R^1～R^4は同一でも、また互いに異なっていてもよく、R^1とR^2及びR^3とR^4は互いに置換している基と結合して、置換もしくは無置換の飽和又は不飽和の五員環あるいは置換もしくは無置換の飽和又は不飽和の六員環を形成してもよい。

【００１４】一方、一般式（Ｉ）中のＡｒは置換もしくは無置換の炭素数６～２０のアリーレン基を表わし、置換もしくは無置換のフェニレン基，ビフェニレン基，ｐ－テルフェニレン基，ナフチレン基，ターフェニレン基，ナフタレンジイル基，アントラセンジイル基，フェナントレンジイル基，フェナレンジイル基等のアリーレン基であり、無置換でも置換されていてもよい。又、メチリディン（＝Ｃ＝ＣＨ－）の結合位置はオルト，メタ，パラ等どこでもよい。但し、Ａｒが無置換フェニレンの場合、R^1～R^4は炭素数１～６のアルコキシ基，炭素数７～１８のアラルキル基，置換あるいは無置換のナフチル基，ビフェニル基，シクロヘキシル基，アリールオキシ基より選ばれたものである。置換基はアルキル基（メチル基，エチル基，ｎ－プロピル基，イソプロピル基，ｎ－ブチル基，イソブチル基，sec －ブチル基，ｔ－ブチル基，イソペンチル基，ｔ－ペンチル基，ネオペンチル基，イソヘキシル基等），アルコキシ基（メトキシ基，エトキシ基，プロポキシ基，イソプロポキシ基，ブチルオキシ基，イソブチルオキシ基，sec －ブチルオキシ基，ｔ－ブチルオキシ基，イソペンチルオキシ基，ｔ－ペンチルオキシ基），アリールオキシ基（フェノキシ基，ナフチルオキシ基等），アシル基（ホルミル基，アセチル基，プロピオニル基，ブチリル基等），アシルオキシ基，アラルキル基（ベンジル基，フェネチル基等），フェニル基，水酸基，カルボキシル基，アニリノカルボニル基，カルバモイル基，アリールオキシカルボニル基，メトキシカルボニル基，エトキシカルボニル基，ブトキシカルボニル基，ニトロ基，ハロゲン原子であり、単一置換でも複数置換されていてもよい。

【００１５】前記一般式（Ｉ）で表わされるメチリディン芳香族化合物は、１分子中に２つのメチリディン（＝Ｃ＝ＣＨ－）基を有し、このメチリディン基の幾何異性によって、４通りの組合わせ、すなわち、シスーシス，トランスーシス，シスートランス及びトランスートランスの組合わせがある。本発明のＥＬ素子における第一発光層は、それらのいずれのものであってもよいし、幾何異性体の混合したものでもよい。特に好ましくは、全てトランス体のものである。また、上記置換基は、置換基の間で結合し、置換、無置換の飽和もしくは不飽和の五員環又は六員環を形成してもよい。

【００１６】一般式（II）におけるＡ及びＢは、それぞれ上記一般式（Ｉ）で表される化合物から１つの水素原子を除いた一価基を示し、同一であっても異なってもよいものである。ここで、一般式（II）におけるＱは共役系を切る二価基を示す。ここで、共役とは、π電子の非極在性によるもので、共役二重結合あるいは不対電子又は孤立電子対によるものも含む。Ｑの具体例としては、

【００１７】

【化８】

15　　16

$-CH_2-$, $-CH_2CH_2-$,

$-CH(CH_3)-CH_2-$, $CH_3-C(CH_3)_2-CH_3$,

$-CH_2CH_2CH_2-$,

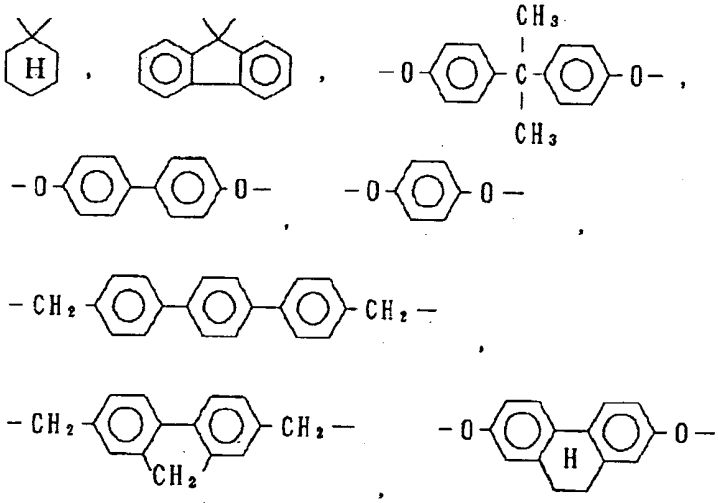
$-O-$, $-O-CO-O-$,

$-OCH_2CH_2O-$,

$-CO-CO-$,

$-COCH_2CO-$,

$-CO(CH_2)_2CO-$,



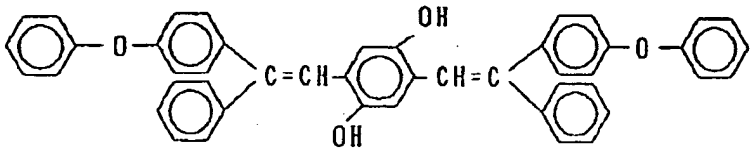
【００１８】が挙げられる。このように共役系を切る二価の基を用いる理由は、上記で示されるＡあるいはＢ（即ち、一般式（Ｉ）の化合物）を、単独で本発明の有機ＥＬ素子として用いた場合に得られるＥＬ発光色と、一般式（II）で表わされる化合物を本発明の有機ＥＬ素子として用いた場合に得られるＥＬ発光色とが変わらぬようにするためである。つまり、一般式（Ｉ）又は一般式（II）で表わされる第一発光層が、短波長化あるいは長波長化したりすることはないようにするためである。また、共役系を切る二価基で接続するとガラス転移温度（Ｔｇ）は、上昇することが確認でき、均一なピンホールフリーの微結晶あるいはアモルファス性薄膜が得られることができ、発光均一性を向上させている。更に、共役系を切る二価基で結合していることにより、ＥＬ発光が長波長化することなく、また、合成あるいは精製が容易にできる長所を備えている。

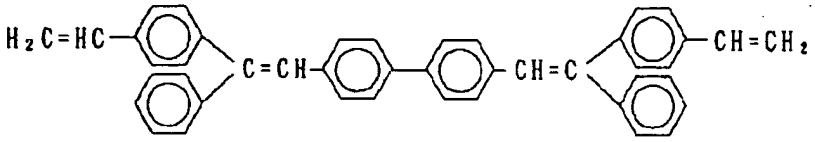
【００１９】また、一般式（III)中のA^1は置換もしくは無置換の炭素数６～２０のアリーレン基又は二価の芳香族複素環式基、A^2は置換もしくは無置換の炭素数６～２０のアリール基（フェニル基，ビフェニル基，ナフチル基等）又は一価の芳香族複素環式基を示す。R^5及びR^6は、それぞれ水素原子，置換もしくは無置換の炭素数６～２０のアリール基，シクロヘキシル基，一価の芳香族複素環式基，炭素数１～１０のアルキル基（メチル基，エチル基，ｎ－プロピル基，イソプロピル基，ｎ－ブチル基，イソブチル基，sec －ブチル基，tert－ブチル基，イソペンチル基，t-ペンチル基，ネオペンチル基，イソヘキシル基等），炭素数７～２０のアラルキル基（ベンジル基，フェネチル基等）又は炭素数１～１０のアルコキシ基（メトキシ基，エトキシ基，プロポキシ基，ブトキシ基等）を示す。なお、R^5，R^6は同一でも異なってもよい。ここで、置換基とは、アルキル基，アリールオキシ基，アミノ基又はこれらの基を有するもしくは有しないフェニル基であり、該置換基は単一でも複数でもよい。R^5の各置換基はA^1と結合して、飽和もしくは不飽和の五員環又は六員環を形成してもよく、同様にR^6の各置換基はA^2と結合して、飽和もしくは不飽和の五員環又は六員環を形成してもよい。また、Ｑは、上記と同様に共役を切る二価基を表す。さらに、該A^1の結合はオルト，メタ，パラのいずれでもよい。さ

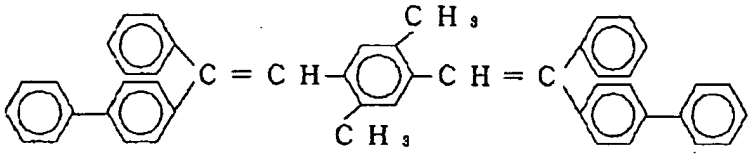
らに、本発明において、上記の一般式（I），一般式（II）又は一般式（III)で表される有機化合物は、ＣＩＥ色度座標における青紫，紫青，青，緑青もしくは青緑の発光を呈する化合物であることが必要である。具体的には、

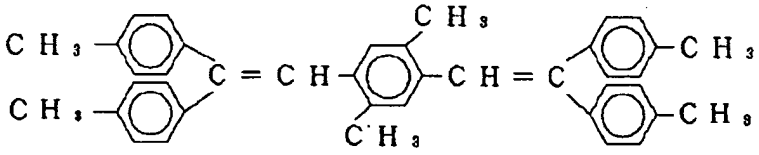
【００２０】

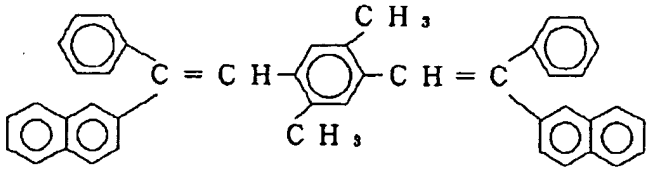
【化９】

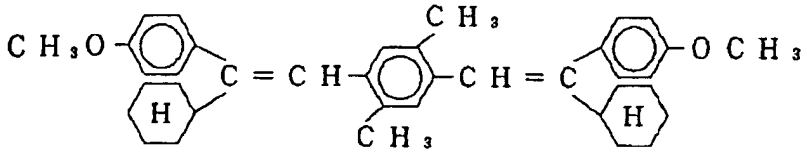








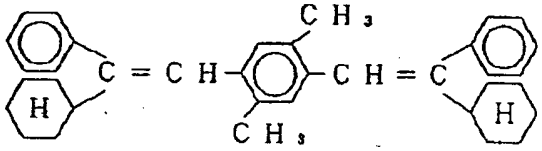


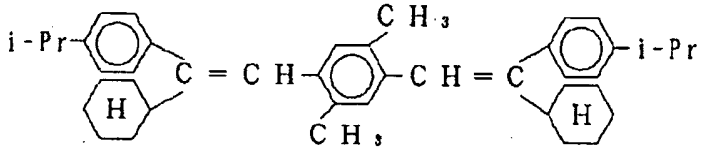


【００２１】

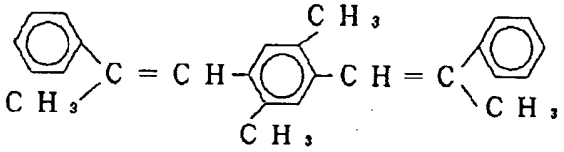
【化１０】

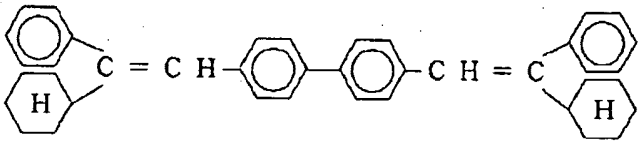
19　　20

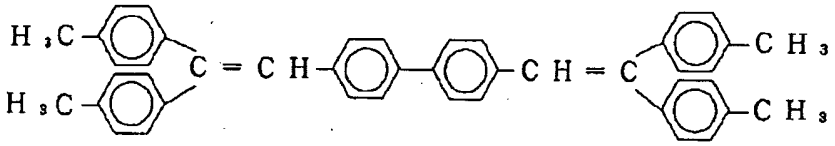


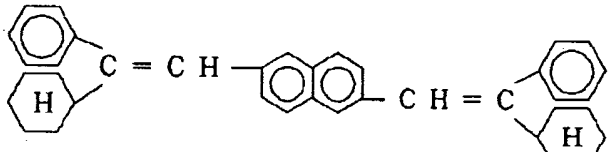


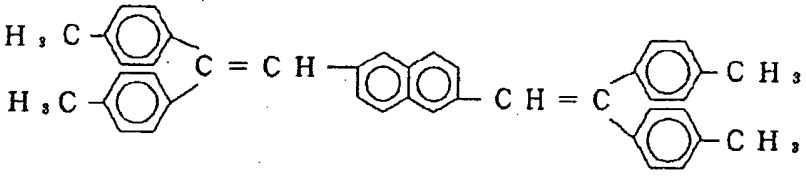
i-Pr　：イソプロピル基，以下同様





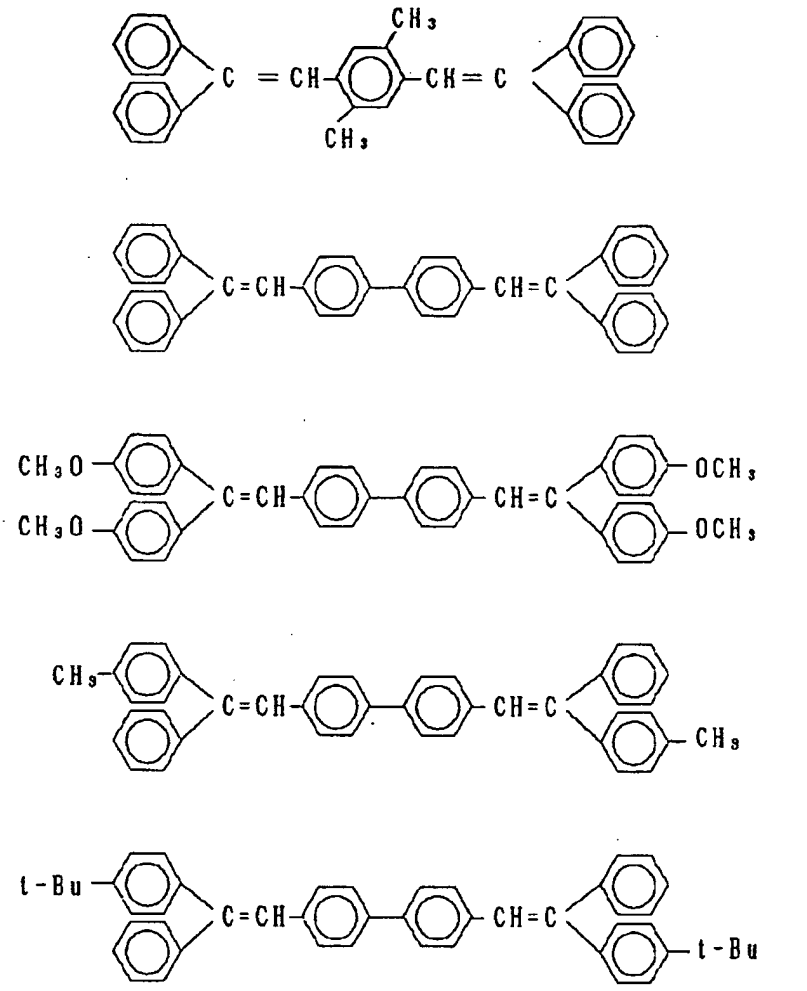






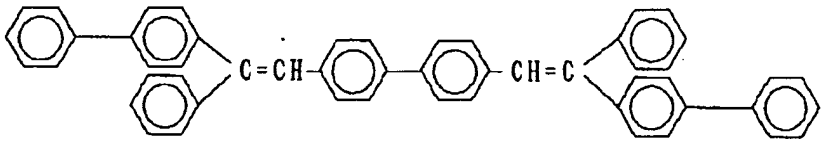
【００２２】

40　【化１１】

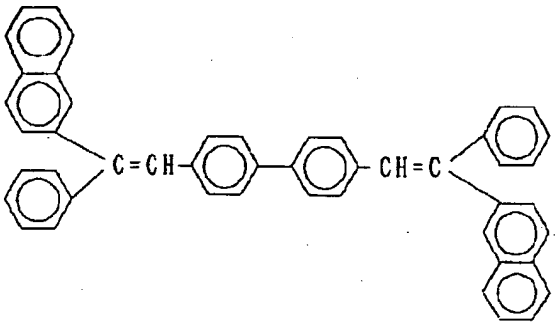


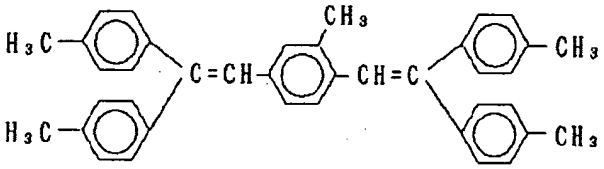
t-Bu：ｔ－ブチル基，以下同様

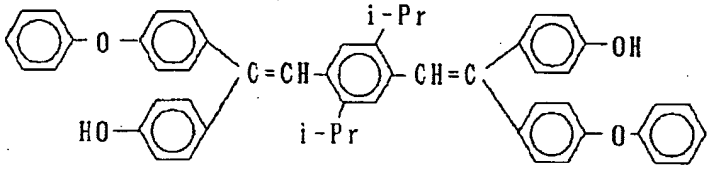
【００２３】 【化１２】

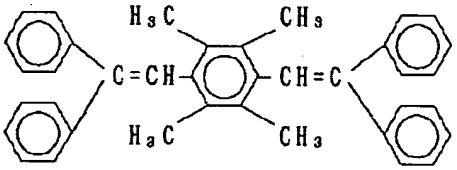


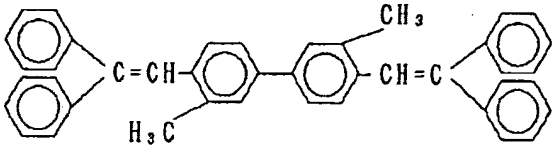
23　　24









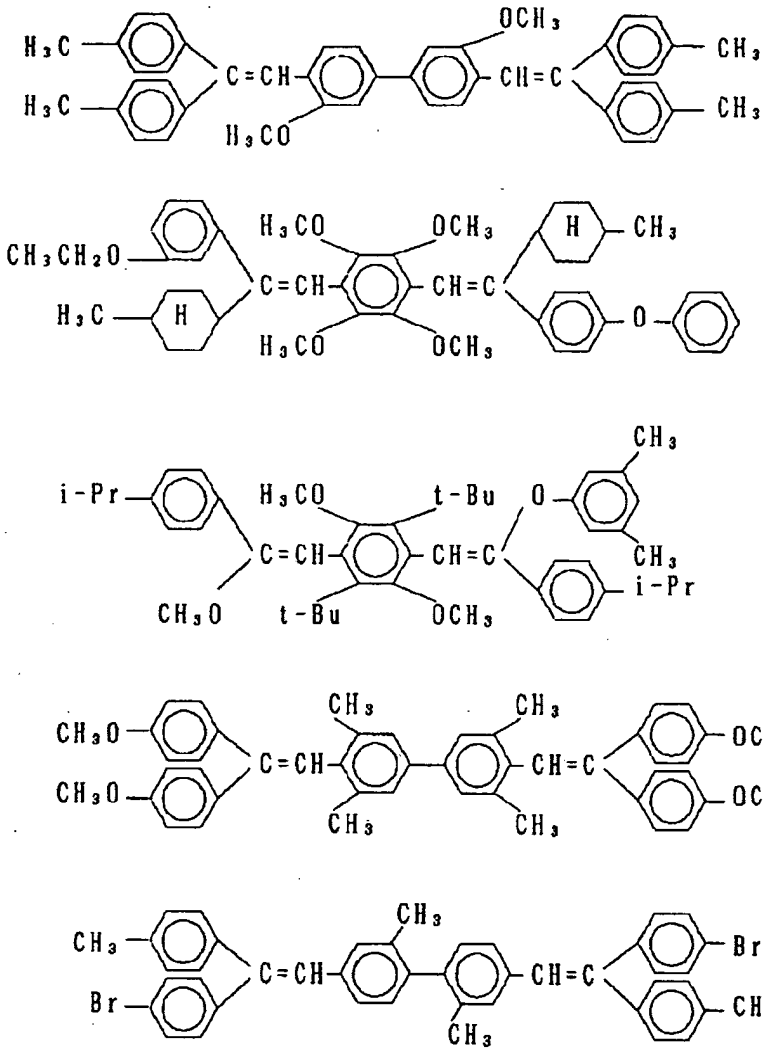


【００２４】

【化１３】

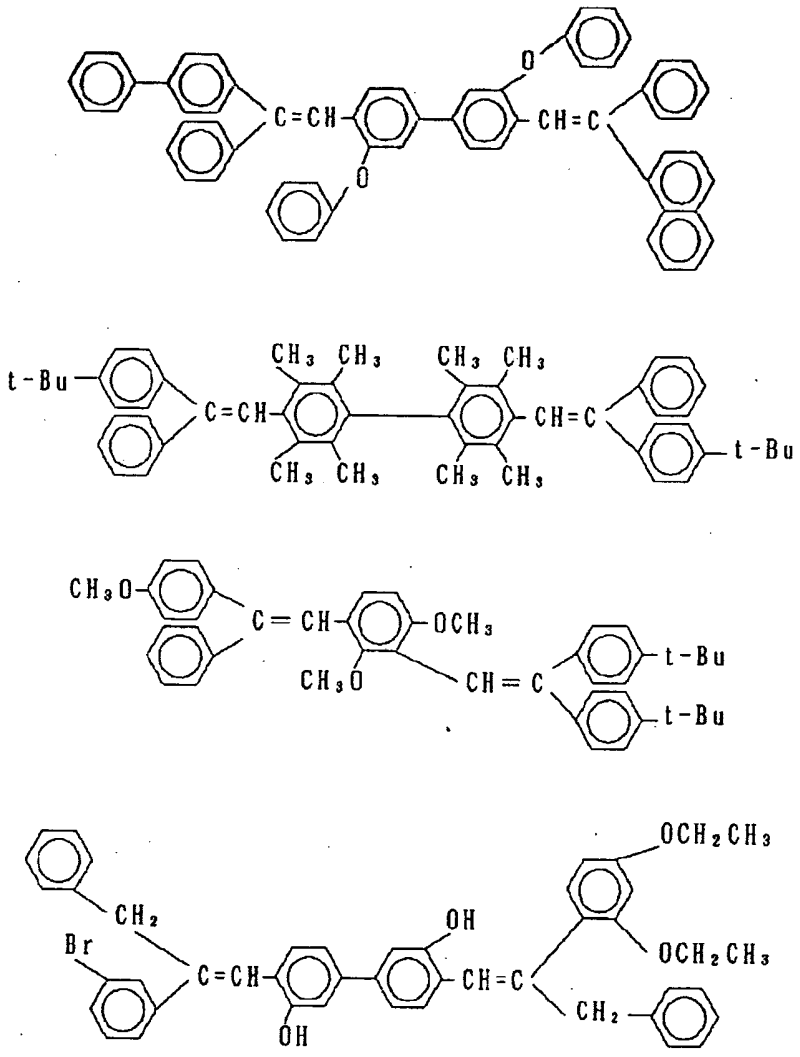
40

50



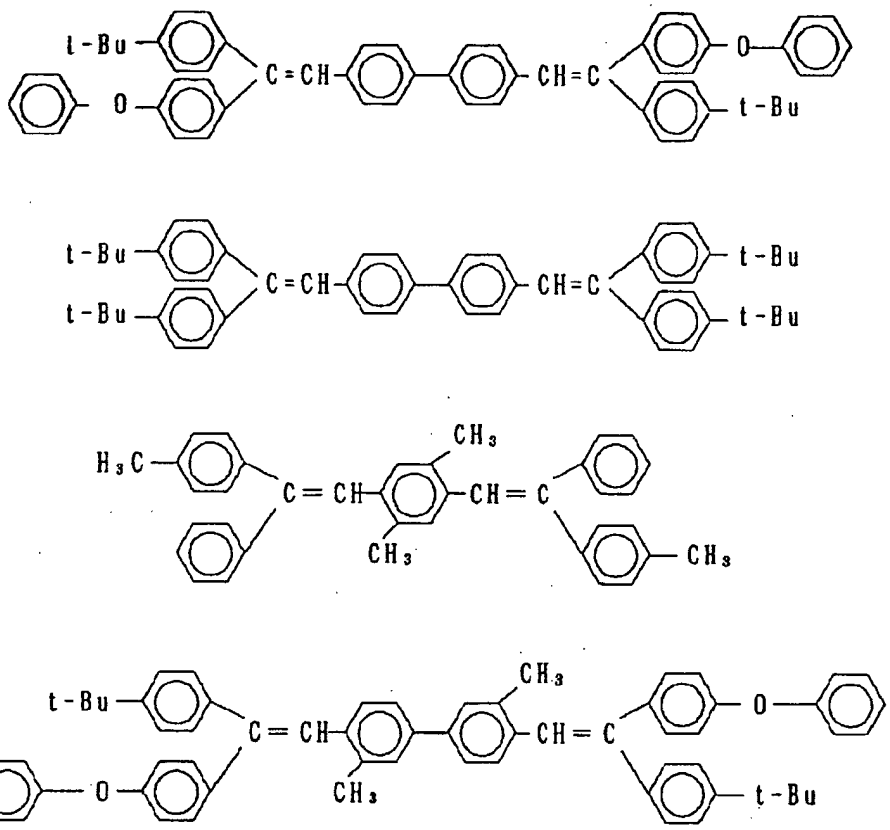
【００２５】

【化１４】



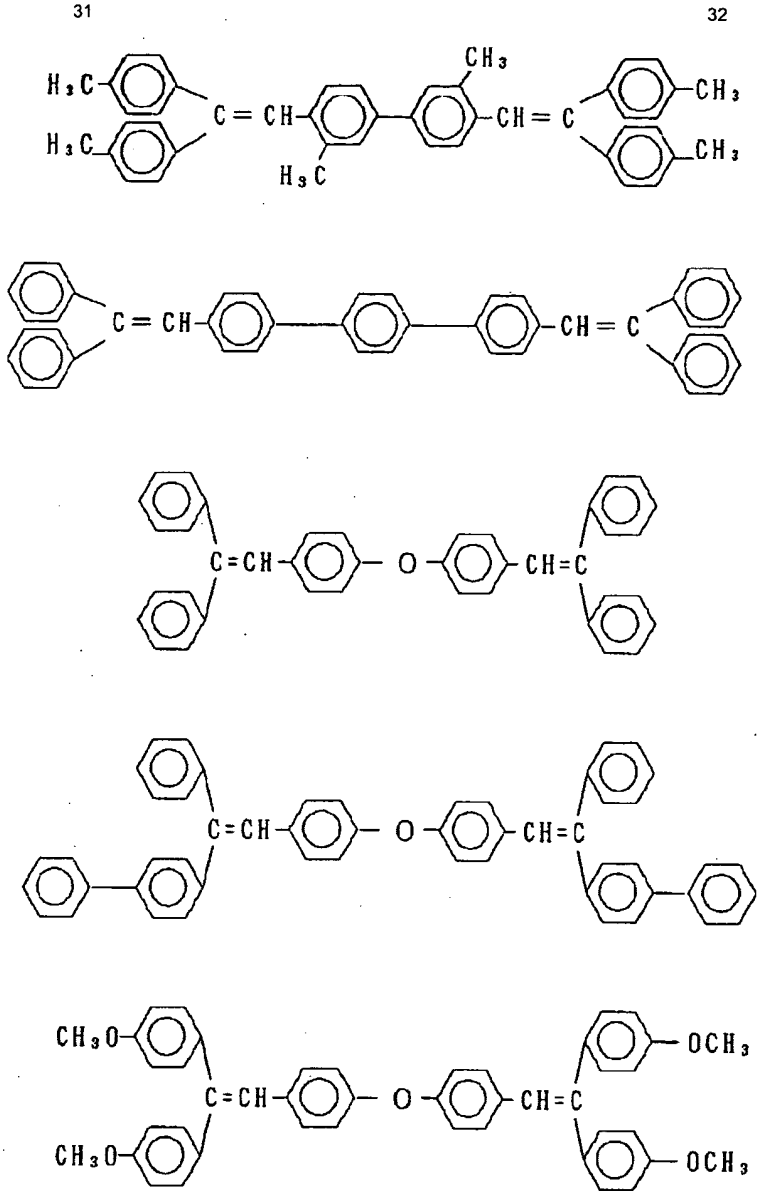
【００２６】

【化１５】



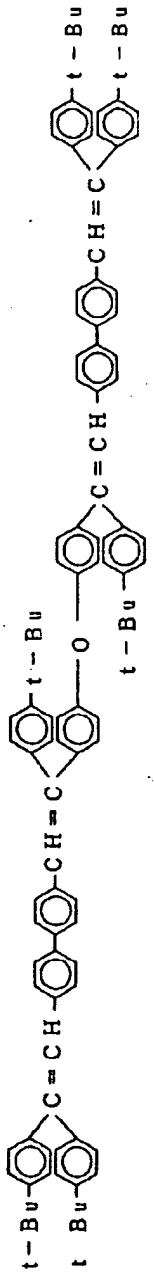
【００２７】

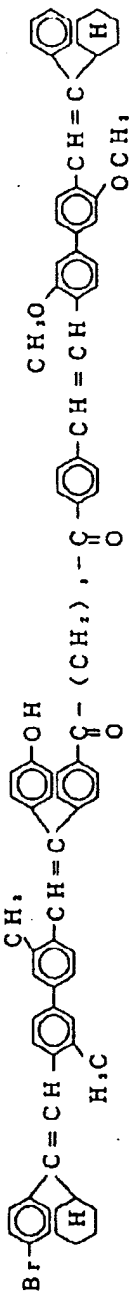
【化１６】

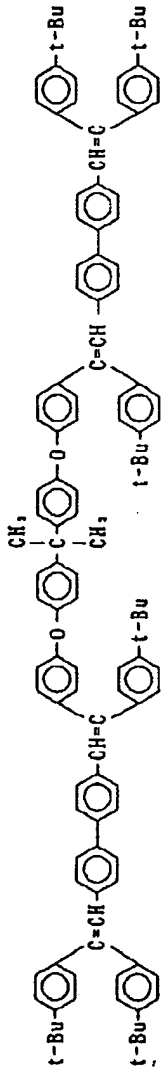


【００２８】

【化１７】

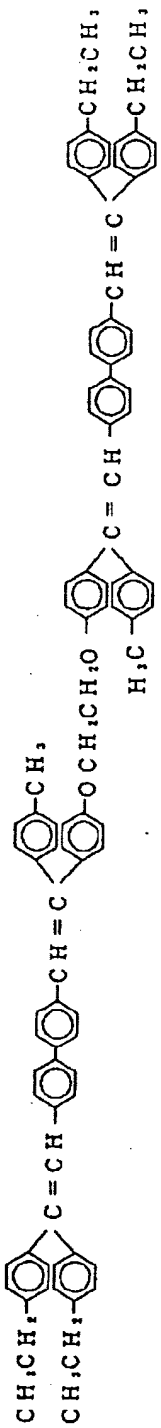


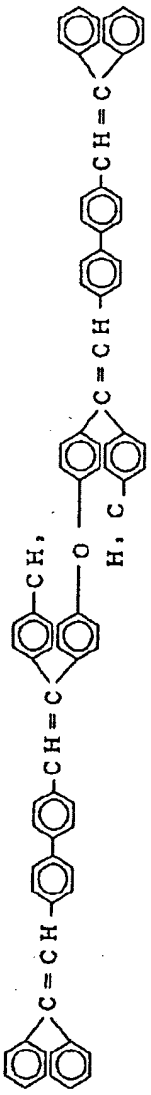




【００２９】
【化１８】

35



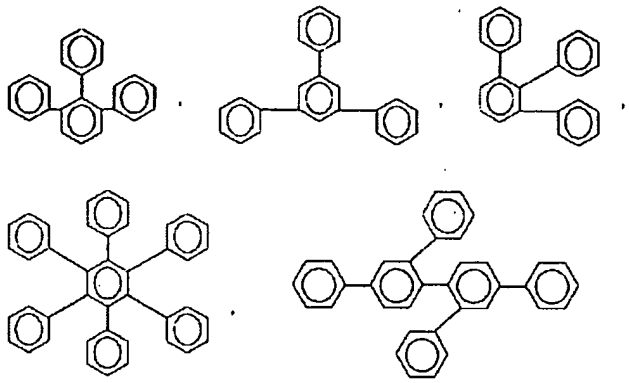


36

【００３０】などである。他の有機化合物としては、

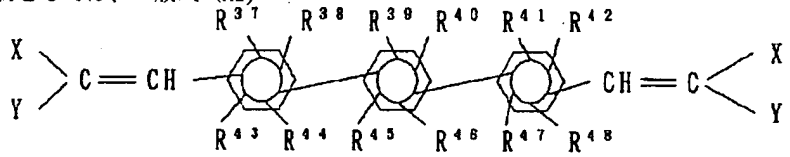
【００３１】

【化１９】



【００３２】なども挙げられる。また、特願平５－１７０３５４号明細書に記載されている上記第一発光層の蛍光条件を満たす化合物としては、一般式（XI）

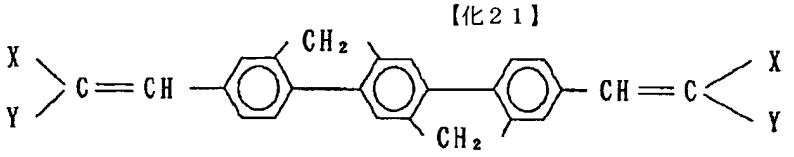
【００３３】
【化２０】



【００３４】〔式中、R^{37}～R^{48}は、それぞれ独立に水素原子又は炭素数１～６のアルキル基を示す。但し、R^{37}～R^{48}のうち少なくとも１つは炭素数１～６のアルキル基である。また、R^{38}とR^{39}，R^{40}とR^{41}，R^{44}とR^{45}，R^{46}とR^{47}は、互いに結合して飽和もしくは不飽和の五員環又は六員環を形成してもよい。Ｘ及びＹはそれぞれ独立に置換又は無置換の炭素数６～２０のアリール基を示す。ＸとＹは置換基と結合して置換もしくは無置換の飽和又は不飽和の五員環あるいは六員環を形成してもよい。ここで、置換基としては炭素数１～６のアルキル基，炭素数１～６のアルコキシ基，炭素数６～１８のアリールオキシ基，フェニル基，アミノ基，シアノ基，ニトロ基，水酸基あるいはハロゲン原子を示す。これらの置換基は単一でも複数置換されていてもよい。〕で表されるターフェニレン誘導体のスチリル化合物を挙げることができる。

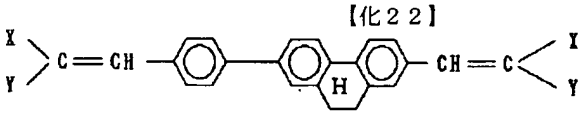
【００３５】ここで、一般式（XI）において、R^{37}～R^{48}は、それぞれ独立に水素原子あるいはメチル基，エチル基，ｎ－プロピル基，イソプロピル基，ｎ－ブチル基，イソブチル基，ｓｅｃ－ブチル基，ｔ－ブチル基，イソペンチル基，ｔ－ペンチル基，ネオペンチル基，ｎ－ヘキシル基，イソヘキシル基などの炭素数１～６のアルキル基を示す。但し、R^{37}～R^{48}のうち少なくとも１つは炭素数１～６のアルキル基であり、特にメチル基又はエチル基が好ましい。また、R^{38}とR^{39}，R^{40}とR^{41}，R^{44}とR^{45}，R^{46}とR^{47}は、互いに結合して飽和もしくは不飽和の五員環又は飽和もしくは不飽和の六員環を形成してもよい。飽和もしくは不飽和の五員環又は六員環を有するスチリル化合物の例としては、R^{38}とR^{39}，及びR^{46}とR^{47}が飽和五員環を形成する場合は、

【００３６】
【化２１】



【００３７】などが挙げられ、R^{46}とR^{47}で飽和六員環を形成する場合には、

【００３８】
【化２２】



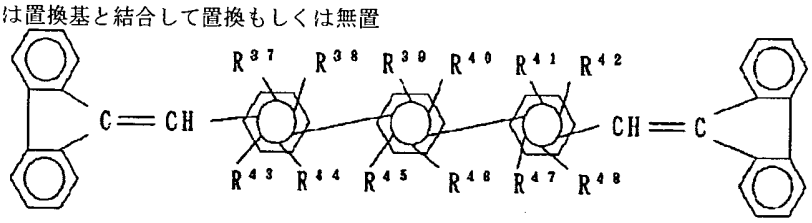
【００３９】などが挙げられる。Ｘ及びＹは、それぞれ独立に置換または無置換のフェニル基，ナフチル基，ビフェニル基，ターフェニル基，アントラリル基，フェナントリル基，ピレニル基，ペリレニル基など炭素数６～２０のアリール基を示す。ここで、置換基としては、例えばメチル基，エチル基，ｎ－プロピル基，イソプロピル基，ｎ－ブチル基，イソブチル基，ｓｅｃ－ブチル基，ｔ－ブチル基，イソペンチル基，ｔ－ペンチル基，ネオペンチル基，ｎ－ヘキシル基，イソヘキシル基などの炭素数１～６のアルキル基、メトキシ基，エトキシ基，ｎ－プロポキシ基，イソプロポキシ基，ｎ－ブチルオキシ基，イソブチルオキシ基，ｓｅｃ－ブチルオキシ

基，イソペンチルオキシ基，ｔ－ペンチルオキシ基，ｎ－ヘキシルオキシ基などの炭素数１～６のアルコキシ基、フェノキシ基，ナフチルオキシ基など炭素数６～１８のアリールオキシ基、フェニル基、アミノ基、シアノ基、ニトロ基、水酸基あるいはハロゲン原子が挙げられる。これらの置換基は単一でも複数置換されていてもよい。また、ＸとＹは置換基と結合して置換もしくは無置

換の飽和又は不飽和の五員環あるいは飽和又は不飽和の六員環を形成してもよい。飽和もしくは不飽和の五員環又は六員環を有するスチリル化合物の例としては、ＸとＹが飽和五員環を形成する場合は、

【００４０】

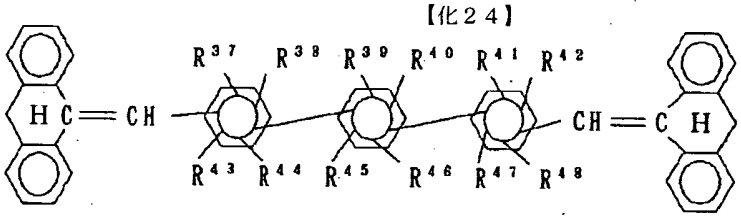
【化２３】



【００４１】などが挙げられ、ＸとＹが飽和六員環形成する場合は、

【００４２】

【化２４】



【００４３】などが挙げられる。

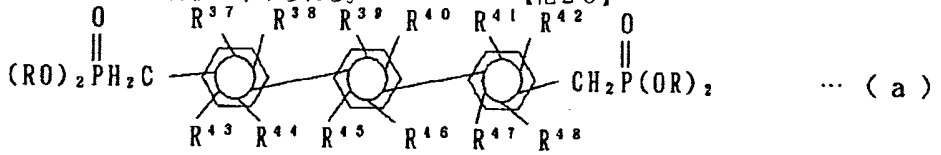
【００４４】上記一般式（XI）で表されるスチリル化合物は、種々の公知の方法によって製造することができる。具体的には、次の２つの方法が挙げられる。

方法１

一般式（ａ）

【００４５】

【化２５】

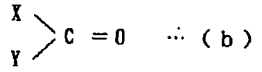


… （ａ）

【００４６】〔式中、Ｒは炭素数１～４のアルキル基又はフェニル基を示し、R^{37}～R^{48}は前記と同じである。〕で表されるホスホン酸エステルと、一般式（ｂ）

【００４７】

【化２６】



… （ｂ）

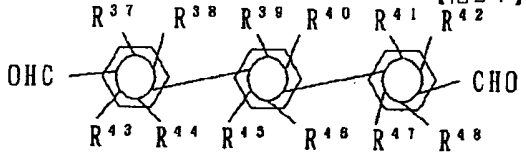
【００４８】〔式中、Ｘ，Ｙは前記と同じである。〕で表されるカルボニル化合物を塩基存在下で縮合する方法（Ｗｉｔｔｉｇ反応又はＷｉｔｔｉｇ－Ｈｏｒｎｅｒ反応）により合成することができる。

方法２

一般式（ｃ）

【００４９】

【化２７】

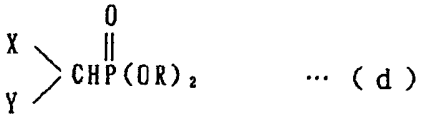


… （ｃ）

【００５０】〔式中、R^{37}～R^{48}は前記と同じである。〕で表されるジアルデヒド化合物と一般式（ｄ）

【００５１】

【化２８】



… （ｄ）

【００５２】〔式中、Ｒ，Ｘ，Ｙは前記と同じである。〕で表されるホスホン酸エステルを塩基存在下で縮合する方法（Ｗｉｔｔｉｇ反応又はＷｉｔｔｉｇ－Ｈｏ

ｒｎｅｒ反応）により合成することができる。

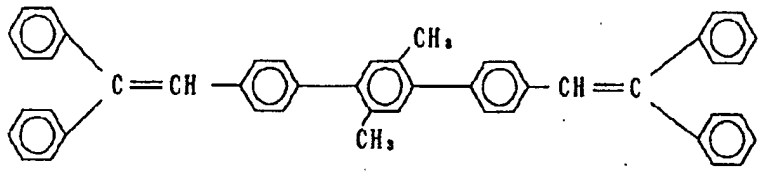
【００５３】この合成で用いる反応溶媒としては、炭化水素，アルコール類，エーテル類が好ましい。具体的には、メタノール；エタノール；イソプロパノール；ブタノール；２－メトキシエタノール；１，２－ジメトキシエタン；ビス（２－メトキシエチル）エーテル；ジオキサン；テトラヒドロフラン；トルエン；キシレン；ジメチルスルホキシド；Ｎ，Ｎ－ジメチルホルムアミド；Ｎ－メチルピロリドン；１，３－ジメチル－２－イミダゾリジノンなどが挙げられる。特に、テトラヒドロフラン，ジメチルスルホキシドが好適である。また、縮合剤としては、水酸化ナトリウム，水酸化カリウム，ナトリウムアミド，水素化ナトリウム，ｎ－ブチルリチウム，ナトリウムメチラート，カリウム－ｔ－ブトキシドなどが好ましく、特にｎ－ブチルリチウム，カリウム－ｔ－ブトキシドが好ましい。反応温度は、用いる反応原料の種類などにより異なり、一義的に定めることはできないが、通常は０℃～約１００℃までの広範囲を指定できる。特に好ましくは０℃～室温の範囲である。

【００５４】以下に、本発明で用いられる上記スチリル化合物の具体例（１）～（２６）を挙げるが、本発明はそれらに限定されるものではない。

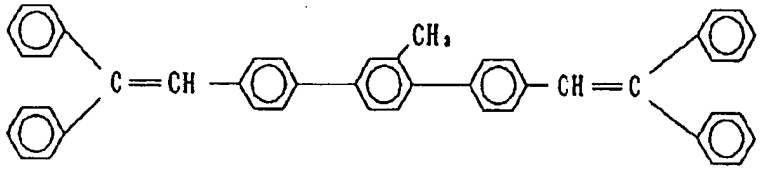
【００５５】

【化２９】

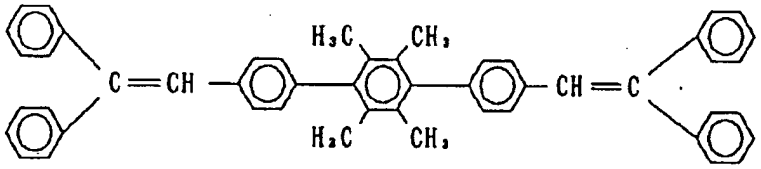
（１）



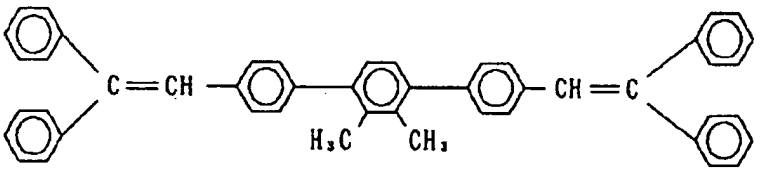
（２）



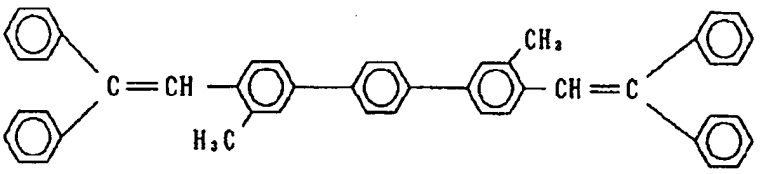
（３）



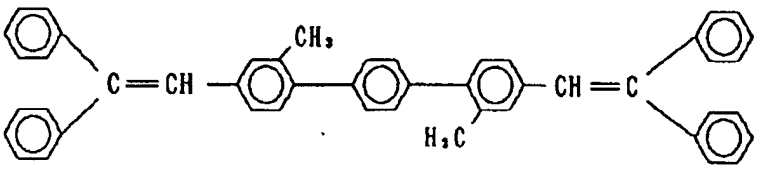
（４）



（５）



（６）

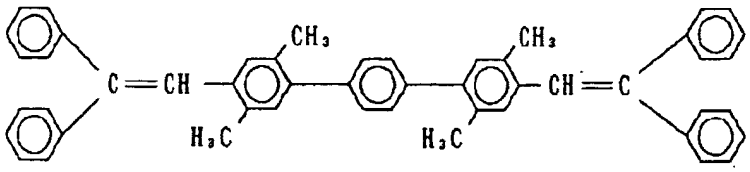


43　　44

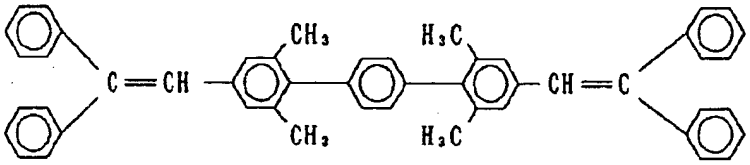
【００５６】

【化３０】

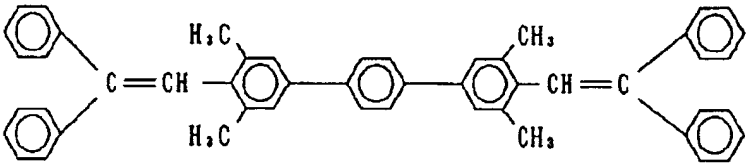
（７）



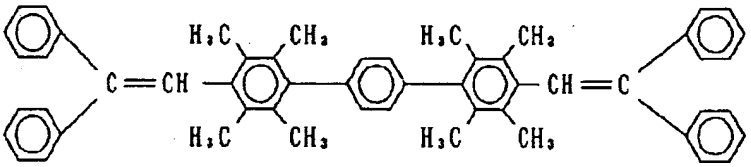
（８）



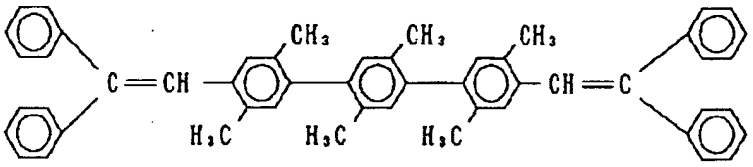
（９）



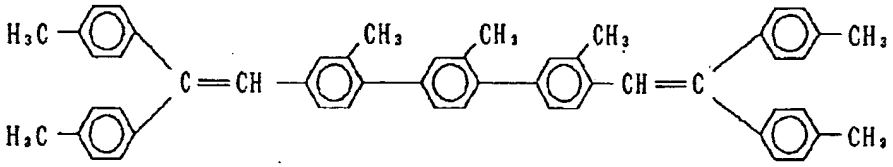
（１０）



（１１）



（１２）

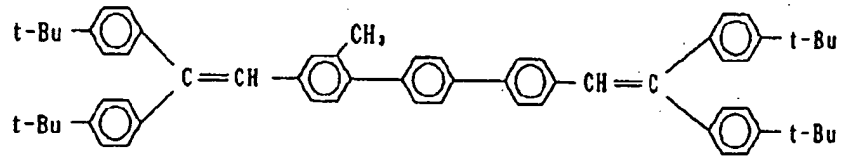


【００５７】

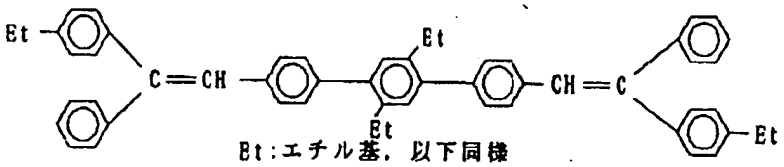
【化３１】

45 46

（１３）

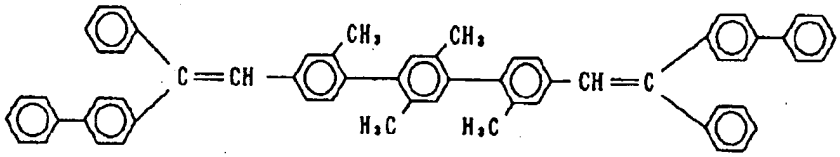


（１４）

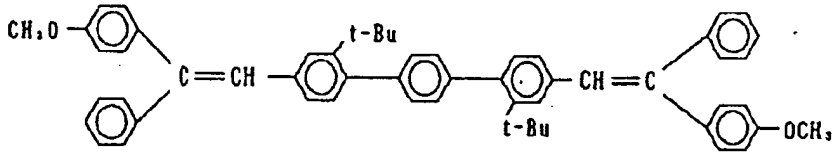


Et：エチル基，以下同様

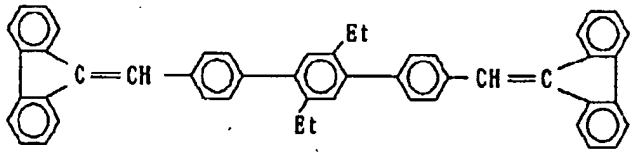
（１５）



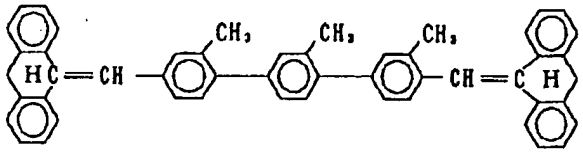
（１６）



（１７）



（１８）



【００５８】

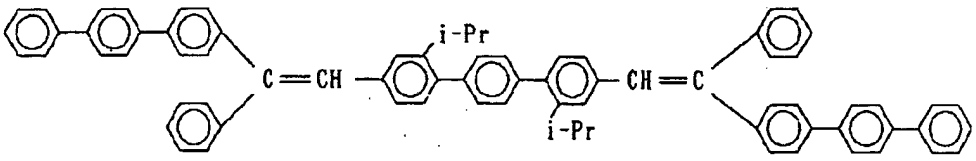
【化３２】

40

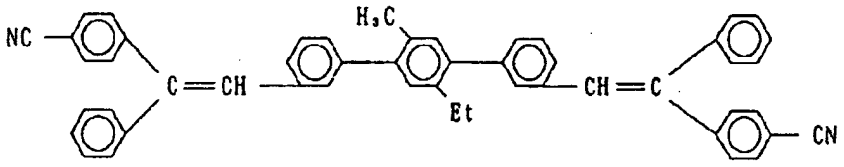
50

47 48

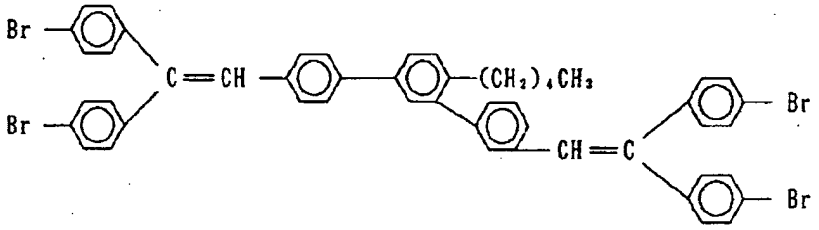
(１９)



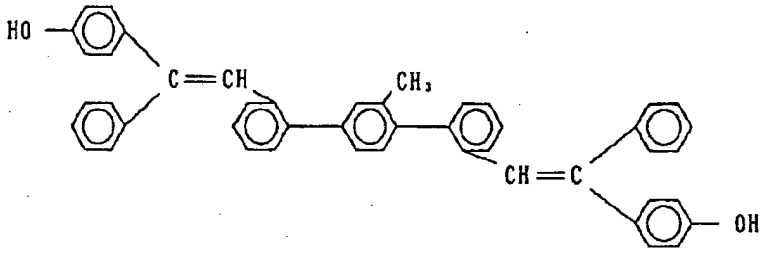
(２０)



(２１)



(２２)



30

【００５９】

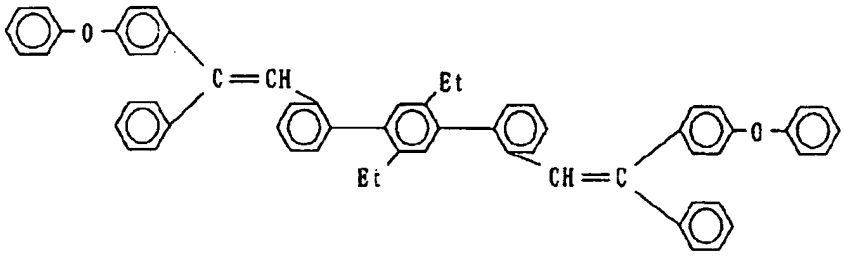
【化３３】

40

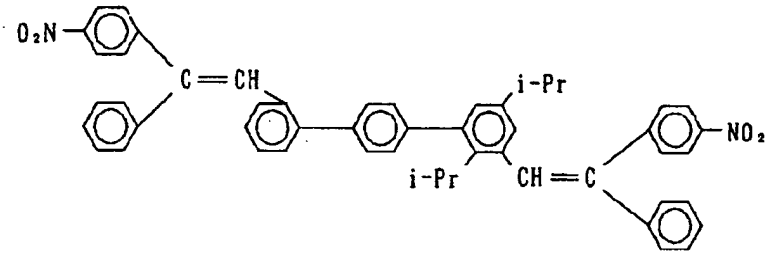
50

49　　50

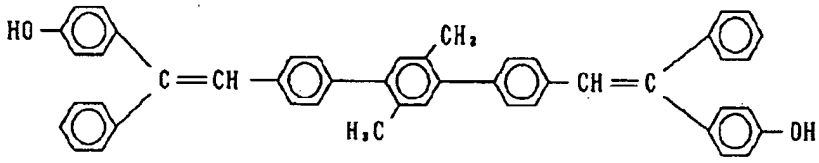
（２３）



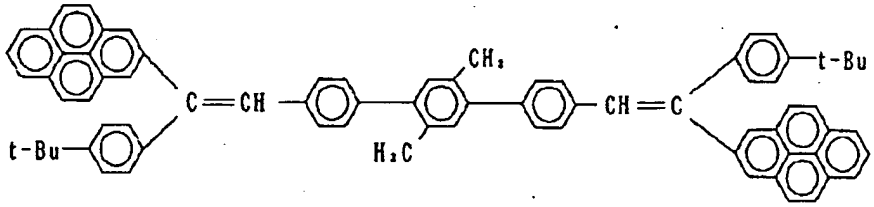
（２４）



（２５）



（２６）



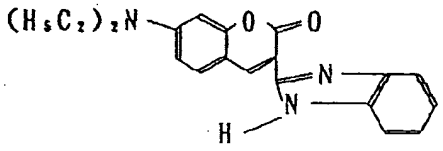
【００６０】一方、第二発光層に用いられる、固体状態の蛍光ピーク波長が４８０ｎｍ以上５８０ｎｍ未満である有機化合物については、特に制限はなく、例えばヨーロッパ公開特許第０２８１３８１号公報に記載されているレーザー色素として用いられるクマリン誘導体が挙げられる。具体的には、

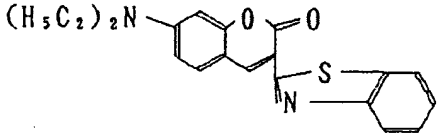
【００６１】

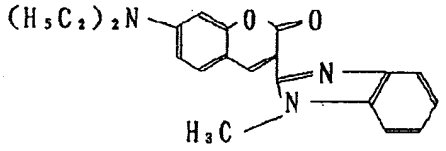
【化３４】

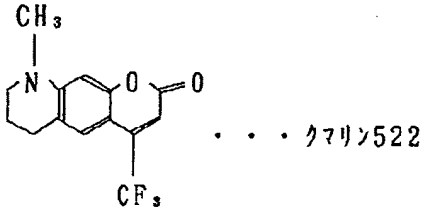
40

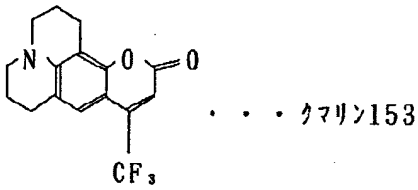
51　　52


・・・クマリン７


・・・クマリン６


・・・クマリン３０

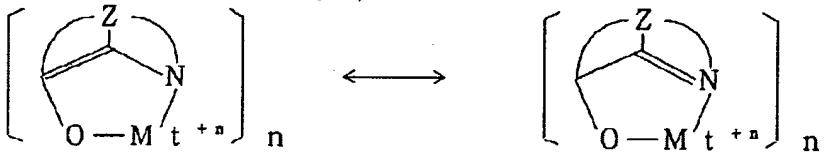

・・・クマリン522


・・・クマリン153

【００６２】などである。さらに、特開平３－２３１９７０号公報あるいは特願平２－２７９３０４号明細書に記載されている有機化合物中で上記第二発光層の蛍光条件を満足するものが挙げられる。さらに、好ましいものとして、８－ヒドロキシキノリン又はその誘導体の金属錯体を挙げることができる。具体的には、オキシン（一般に８－キノリノールまたは８－ヒドロキシキノリン）のキレートを含む金属キレートオキシノイド化合物である。このような化合物は高水準の性能を示し、容易に薄膜形態に成形される。オキシノイド化合物の例は下記構造式を満たすものである。

【００６３】

【化３５】



【００６４】〔式中、Ｍｔは金属を表し、ｎは１～３の整数であり、且つ、Ｚはその各々の位置が独立であって、少なくとも２以上の縮合芳香族環を完成させるために必要な原子を示す。〕ここで、Ｍｔで表される金属は、一価，二価又は三価の金属とすることができるものであり、例えばリチウム，ナトリウムまたはカリウム等のアルカリ金属、マグネシウム又はカルシウム等のアルカリ土類金属、ホウ素又はアルミニウム等の土類金属である。一般に有用なキレート化合物であると知られている一価，二価または三価の金属はいずれも使用することができる。

【００６５】また、Ｚは、少なくとも２以上の縮合芳香族環の一方がアゾールまたはアジンからなる複素環を形成させる原子を示す。ここで、もし必要であれば、上記縮合芳香族環に他の異なる環を付加することが可能である。また、機能上の改善が無いまま嵩ばった分子を付加することを回避するため、Ｚで示される原子の数は１８以下に維持することが好ましい。

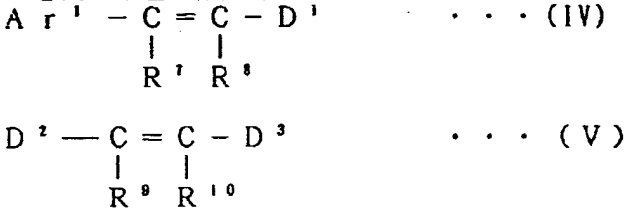
【００６６】さらに、具体的にキレート化オキシノイド化合物を例示すると、トリス（８－キノリノール）アルミニウム，ビス（８－キノリノール）マグネシウム，ビス（８－キノリノール）亜鉛，ビス（２－メチル－８－キノリノール）亜鉛，ビス（ベンゾ－８－キノリノール）亜鉛，ビス（２－メチル－８－キノリラート）アルミニウムオキシド，トリス（８－キノリノール）インジウム，トリス（５－メチル－８－キノリノール）アルミニウム，８－キノリノールリチウム，トリス（５－クロロ－８－キノリノール）ガリウム，トリス（２－メチル－８－キノリノール）ガリウム，ビス（５－クロロ－８－キノリノール）カルシウム，５，７－ジクロル－８－キノリノールアルミニウム，トリス（５，７－ジブロモ－８－ヒドロキシキノリノール）アルミニウム，トリス

（７－プロピル－８－キノリノール）アルミニウム，ビス（８－キノリノール）ベリリウム，ビス（２－メチル－８－キノリノール）ベリリウムなどがある。

【００６７】本発明の白色有機ＥＬ素子においては、前記第一発光層及び／又は第二発光層に、特願平５－１２９４３８号明細書に記載されているスチルベン誘導体，ジスチリルアリーレン誘導体及びトリススチリルアリーレン誘導体の中から選ばれた少なくとも一種を含有させるのが好ましい。該スチルベン誘導体とは、少なくとも２つの芳香族環を有し、これら芳香族環をビニル基又は置換されたビニル基により結合して構成され、かつ上記芳香族環又はビニル基のいずれかに電子供与性基を有する化合物である。ジスチリルアリーレン誘導体とは、１つのアリーレン基に２つの芳香族環がビニル基又は置換ビニル基を介して結合し、かつ電子供与性基を有する化合物である。トリススチリルアリーレン誘導体とは、１つの３価の芳香族環基に３つの芳香族環がビニル基または置換ビニル基を介して結合し、かつ電子供与性基を有する化合物である。電子供与性基を分子骨格に有する前記誘導体において該電子供与性基とは、好ましくは炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基および炭素数１～３０の炭化水素基を有するアミノ基を示す。上記誘導体において、特に好ましいものは下記一般式（IV）～（X）で表される化合物であり、（IV）及び（V）はスチルベン誘導体，（VI）及び（VII)はジスチリルアリーレン誘導体，（VIII）～（X）はトリススチリルアリーレン誘導体を表す。

【００６８】

【化３６】



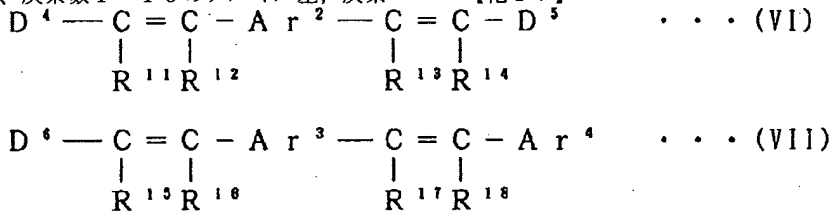
・・・（IV）

・・・（V）

【００６９】〔式中、Ar^1 は炭素数６～２０のアリール基を示す。R^7 ～R^{10} は、それぞれ独立に水素原子又は炭素数６～２０のアリール基を示す。D^1 ～D^3 は、それぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。ここで、Ar^1，R^7 ～R^{10} は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基，炭素数６～１０のアラルキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。また、この置換基が互いに結合し飽和もしくは不飽和の五員環ないし六員環を形成してもよい。〕

【００７０】

【化３７】



・・・（VI）

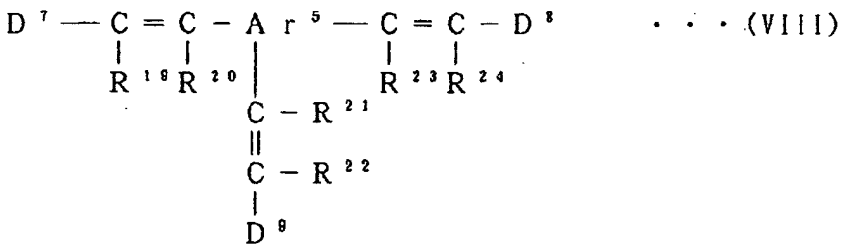
・・・（VII）

【００７１】〔式中、Ar^2 およびAr^3 は、それぞれ独立に炭素数６～２０のアリーレン基を示し、Ar^4 は炭素数６～２０のアリール基を示す。R^{11} ～R^{18} は、それぞれ独立に水素原子又は炭素数６～２０のアリール基を示す。ここで、Ar^2 ～Ar^4，R^{11} ～R^{18} は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアリールオキシ基，炭素数６～１０のアラルキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。また、これらの置換基が互いに結合して飽和もしくは不飽和の五員環ないし六員環を形成してもよい。D^4 ～D^6 は、それぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。〕

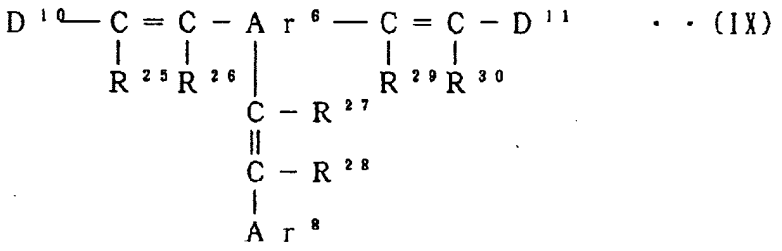
【００７２】

【化３８】

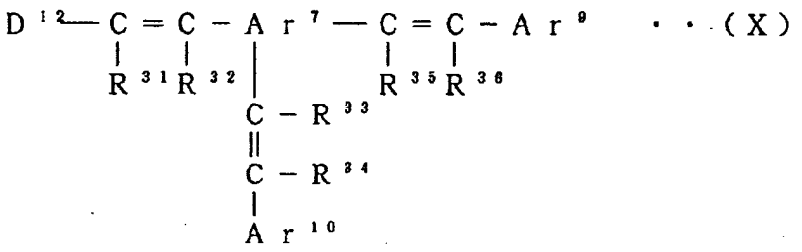
55　　56



・・・(VIII)



・・(IX)

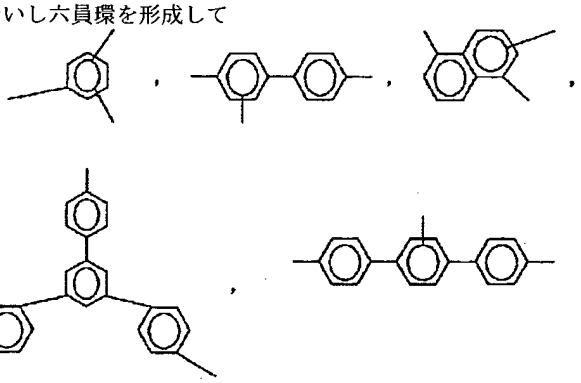


・・(X)

【００７３】〔式中、Ａｒ^{5}～Ａｒ^{7}は、それぞれ独立に炭素数６～２４の３価の芳香族環基を示し、Ａｒ^{8}～Ａｒ^{10}は、それぞれ独立に炭素数６～２０のアリール基を示す。Ｒ^{19}～Ｒ^{36}は、それぞれ独立に水素原子または炭素数６～２０のアリール基を示す。Ｄ^{7}～Ｄ^{12}は、それぞれ独立に電子供与性基で置換された炭素数６～２０のアリール基又は炭素数１０～３０の縮合多環族基を示す。ここで、Ａｒ^{5}～Ａｒ^{7}，Ｒ^{19}～Ｒ^{36}は、それぞれ独立に無置換でもよいし、炭素数１～１０のアルキル基，炭素数１～１０のアルコキシ基，炭素数６～１０のアラルキル基，炭素数６～１０のアリールアルキル基又は炭素数１～２０の炭化水素基を有するアミノ基で置換されていてもよい。また、これらの置換基が互いに結合し飽和もしくは不飽和の五員環ないし六員環を形成してもよい。〕上記一般式（IV）～（X）におけるアリール基としては、好ましくはフェニル基，ビフェニルイル基，ナフチル基，ピレニル基，ターフェニルイル基，アントラニル基，トリル基，キシリル基，スチルベニル基，チエニル基，ビチエニル基，チオフェン基，ビチオフェン基，ターチオフェン基などが挙げられる。アリーレン基としては、好ましくはフェニレン基，ビフェニレン基，ナフチレン基，アントラニレン基，ターフェニレン基，ピレニレン基，スチルベニレン基，チエニレン基，ビチエニレン基などが挙げられる。３価の芳香族環基とは、好ましくは

【００７４】

【化３９】



【００７５】が挙げられる。また、上記置換基であるアリールオキシ基としては、フェニルオキシ基，ビフェニルオキシ基，ナフチルオキシ基，アントラニルオキシ基，ターフェニルオキシ基，ピレニルオキシ基などが挙げられ、アルキル基としては、メチル基，エチル基，イソプロピル基，ターシャルブチル基，ペンチル基，ヘキ

シル基などが挙げられる。アルコキシ基としては、メトキシ基，エトキシ基，イソプロポキシ基，ターシャルブトキシ基，ペンチルオキシ基などが挙げられ、炭化水素基を有するアミノ基としては、ジメチルアミノ基，ジエチルアミノ基，ジフェニルアミノ基，フェニルエチルアミノ基，フェニルメチルアミノ基，ジトリルアミノ基，エチルフェニルアミノ基，フェニルナフチルアミノ基，フェニルビフェニルアミノ基などが挙げられる。前記一般式（IV）～（X）におけるD^1 ～D^{12}は、電子供与性基で置換された炭素数１～２０のアリール基、又は炭素数１０～３０の縮合多環族基である。ここで、電子供与性基とは、好ましくは炭素数１～１０のアルコキシ基，炭素数６～２０のアリールオキシ基，炭素数１～３０の炭化水素基を有するアミノ基が挙げられ、特に好ましくは炭素数１～３０の炭化水素基を有するアミノ基が挙げられる。このアミノ基としては、一般式（XII）

【００７６】

【化４０】

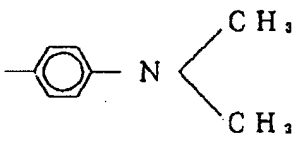
$$-N\begin{matrix}X^1\\ \diagup\\ \diagdown\\ X^2\end{matrix} \quad \cdots (XII)$$

【００７７】〔式中、X^1 及びX^2 は、それぞれ独立に炭素数６～２０のアリール基，炭素数１～１０のアルキル基又は炭素数６～２０のアラルキル基を示し、互いに結合して飽和又は不飽和の環状構造を形成してもよい。また、X^1，X^2 には、炭素数１～１０のアルキル基，炭素数７～１０のアラルキル基，炭素数６～１０のアリールオキシ基又は炭素数６～１０のアルコキシ基が置換してもよい。さらに、一般式（XII）で表されるアミノ基に置換するアリール基としてのX^1 とX^2 が互いに結合した含窒素芳香族環基となってもよい。〕で表されるものが挙げられる。上記電子供与性基としては、例えばフェニルオキシ基，ビフェニルオキシ基，ナフチルオキシ基，アントラニルオキシ基，ターフェニルイルオキシ基などのアリールオキシ基、メトキシ基，エトキシ基，イソプロポキシ基，ターシャルブチルオキシ基，ペンチルオキシ基などのアルコキシ基、ジメチルアミノ基，ジエチルアミノ基，ジフェニルアミノ基，フェニルメチルアミノ基，フェニルエチルアミノ基，フェニルメチルエチルアミノ基，ジトリルアミノ基，エチルフェニルアミノ基，フェニルナフチルアミノ基，フェニルビフェニルイルアミノ基などの炭化水素基を有するアミノ基などが挙げられる。また、D^1 ～D^{12} の具体例としては、

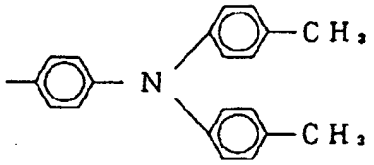
【００７８】

【化４１】

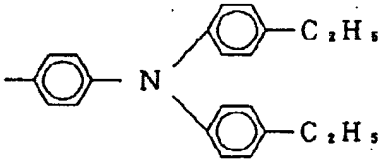
59



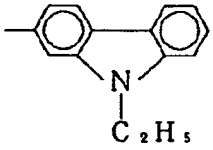
,



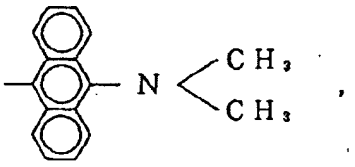
,



,

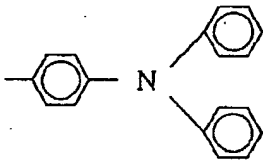


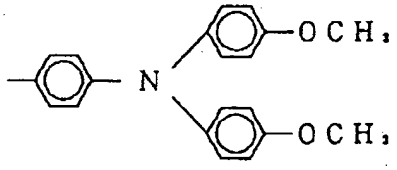
,

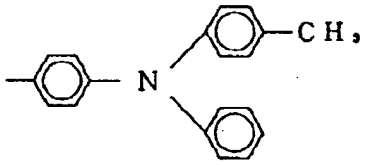


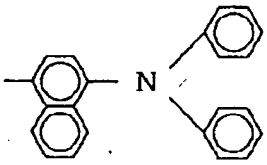
,

60









30

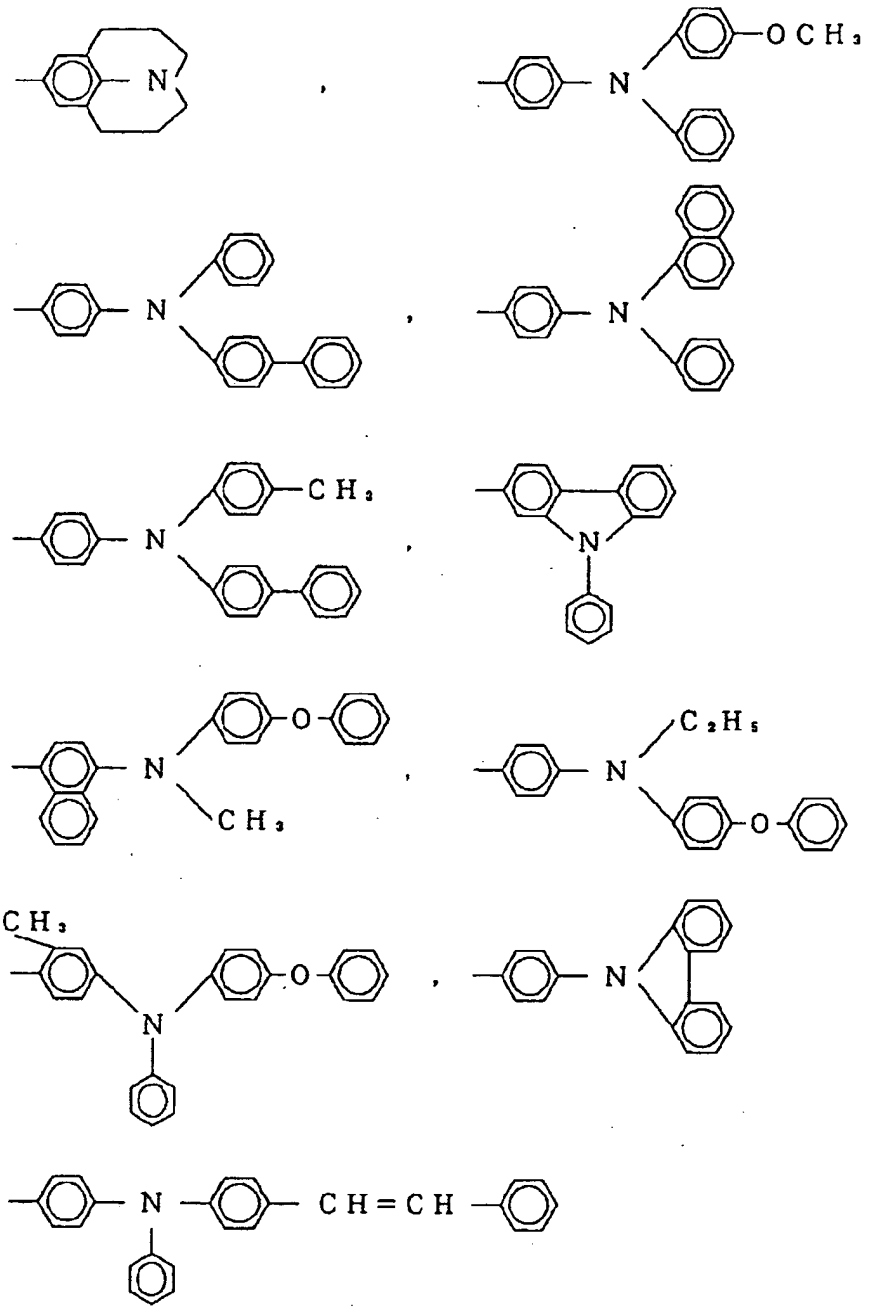
【００７９】

【化４２】

40

50

61 62



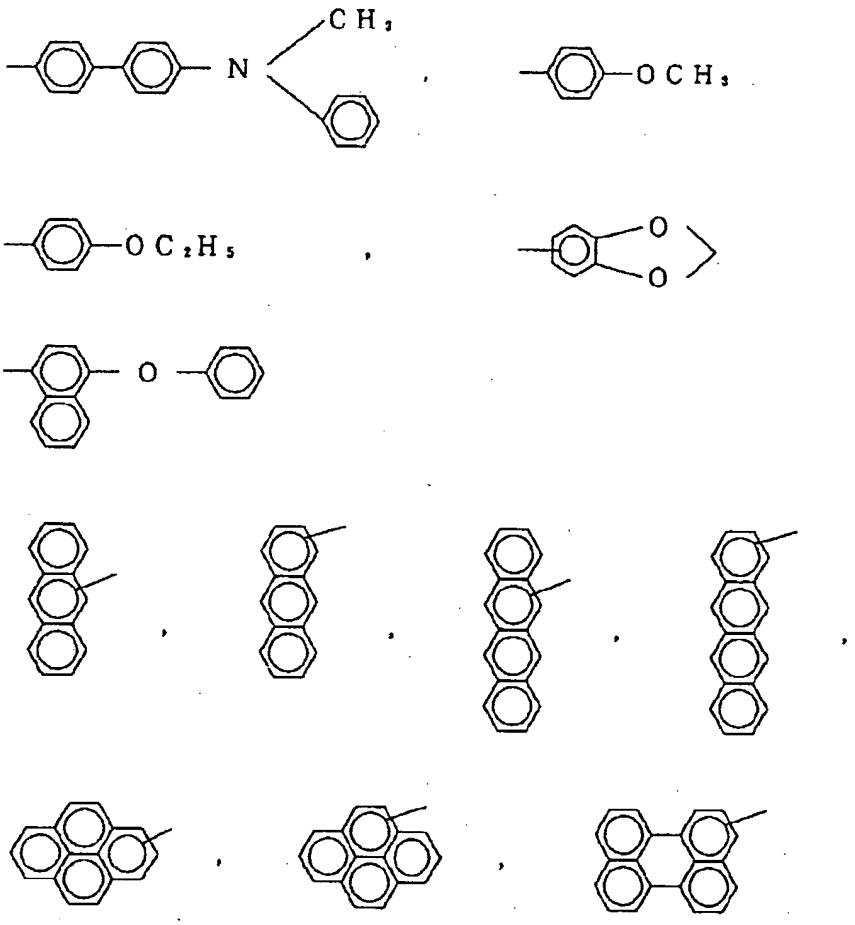
【００８０】

【化４３】

40

50

63　　64



【００８１】

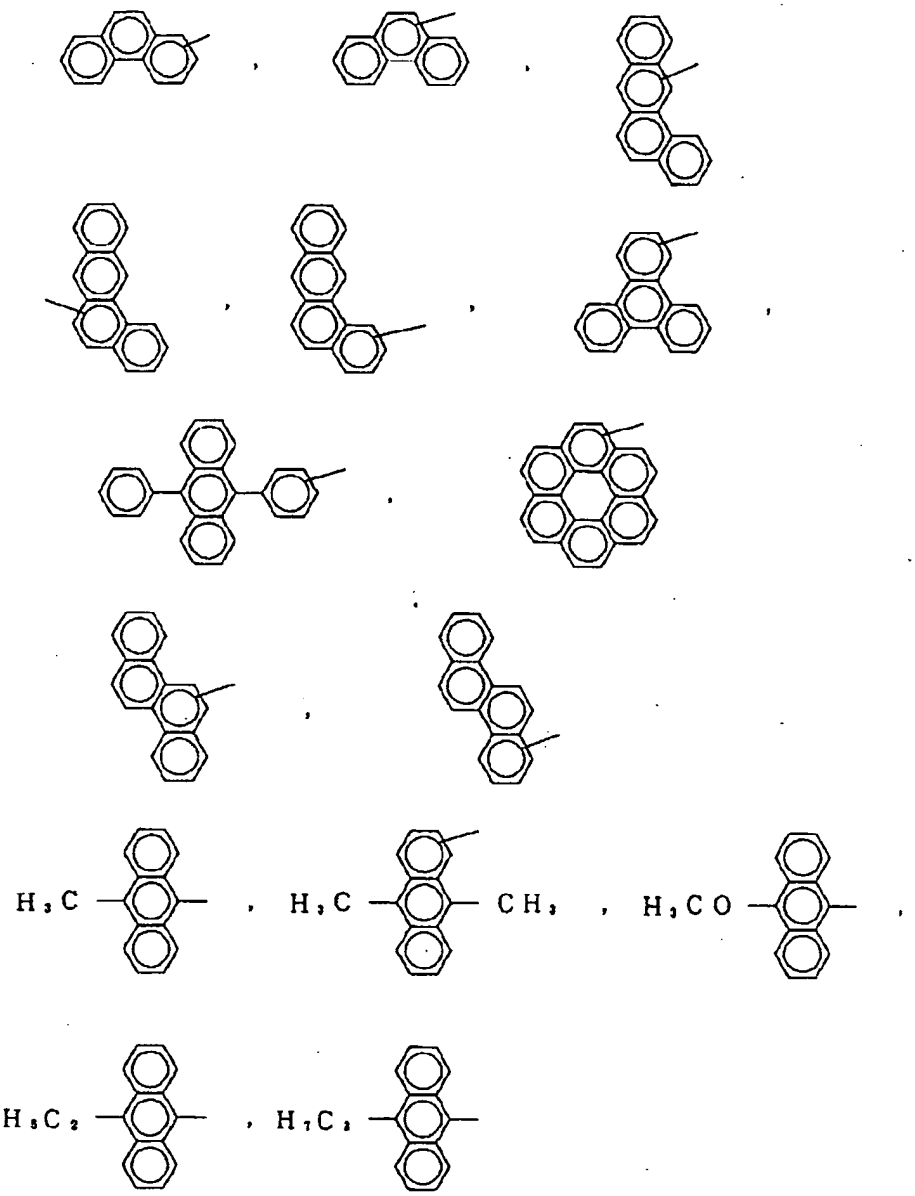
【化４４】

30

40

50

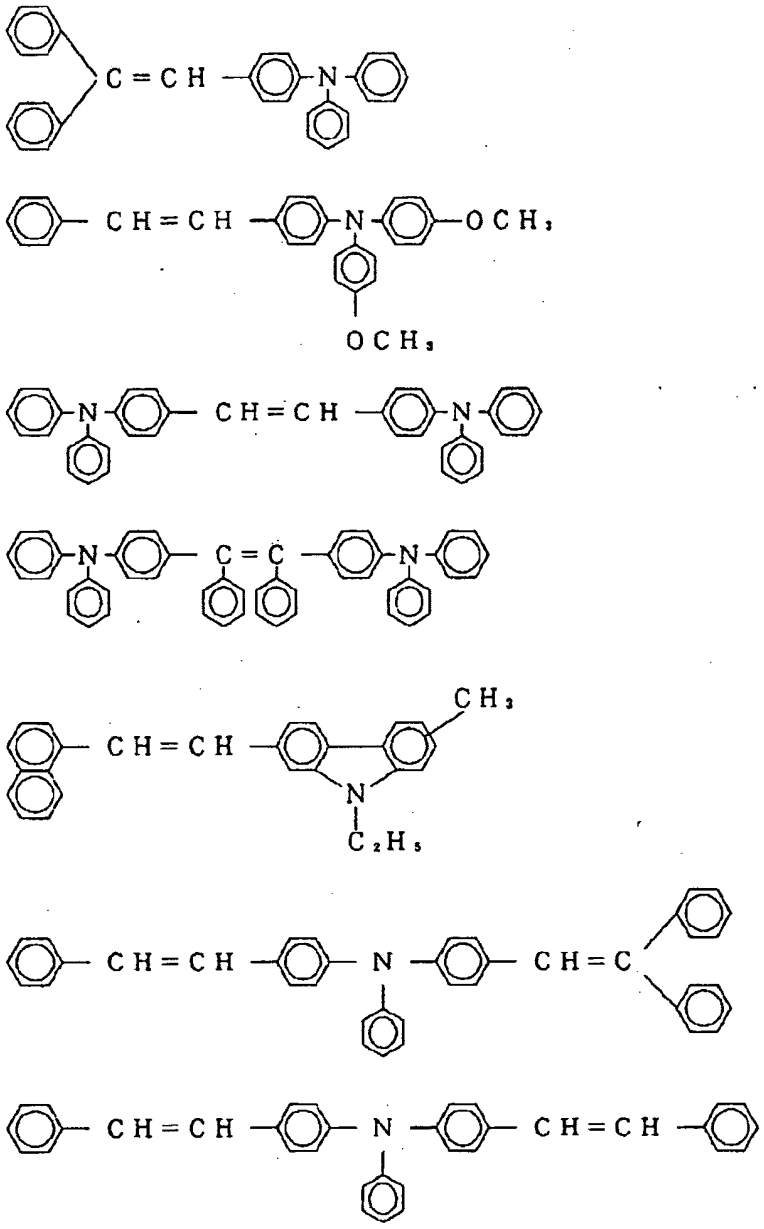
65　　66



【００８２】などが挙げられる。上記一般式（IV）～（X）で表される化合物の具体例としては、

【００８３】
【化４５】

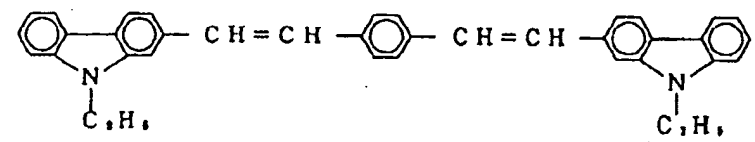
67　　68

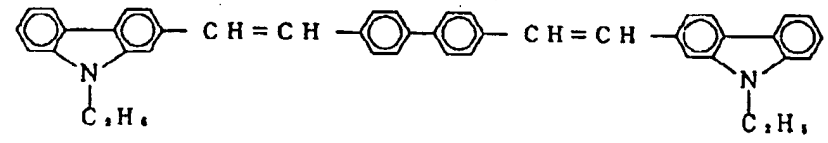


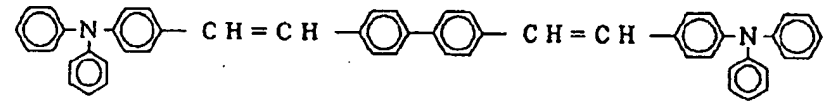
【００８４】

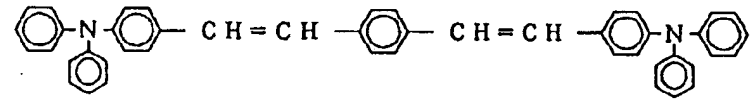
【化４６】

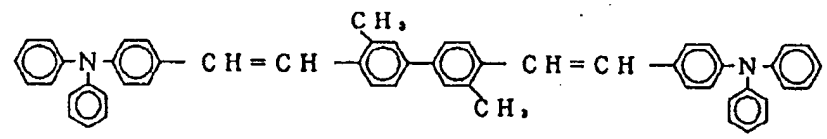
69　　70

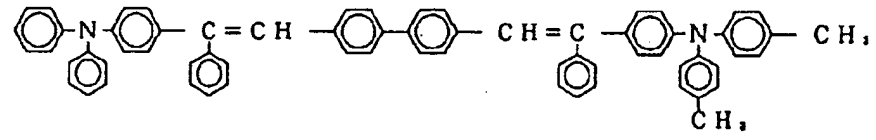


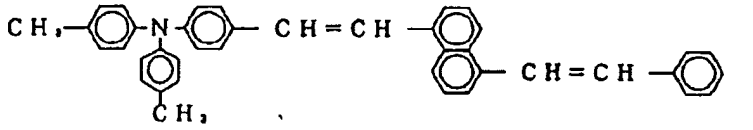










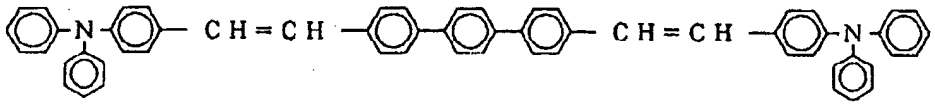


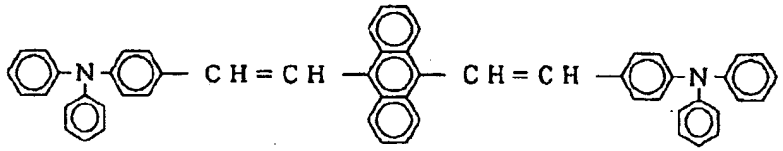
【００８５】　　【化４７】

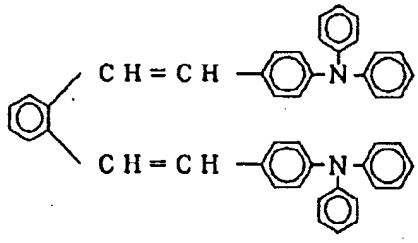
40

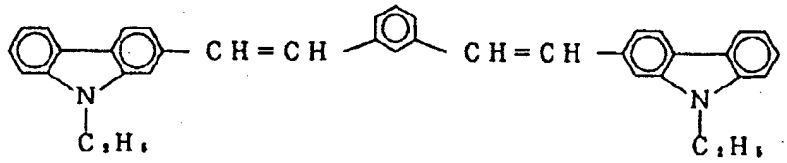
50

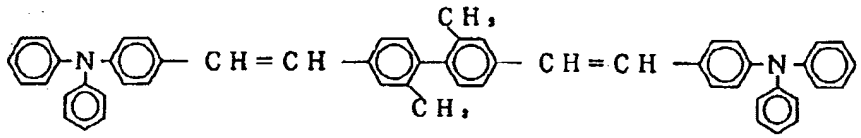
71 72

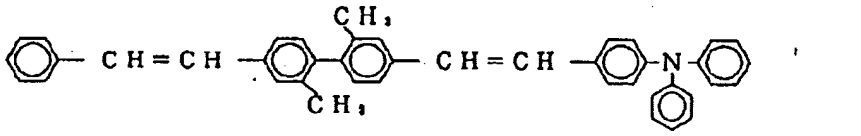








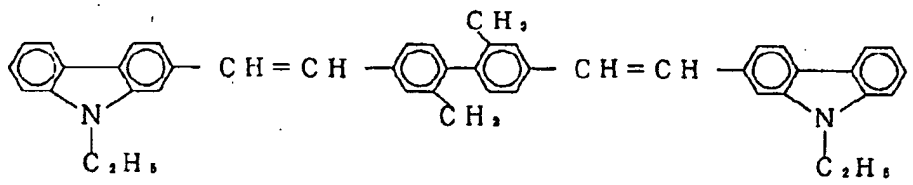


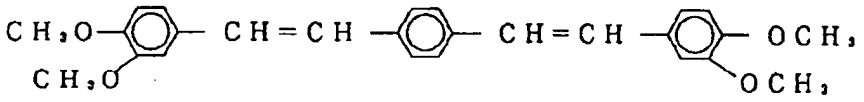


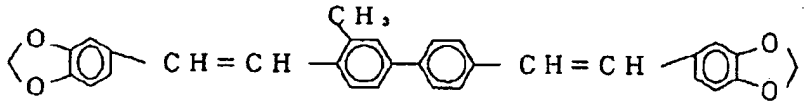
【００８６】

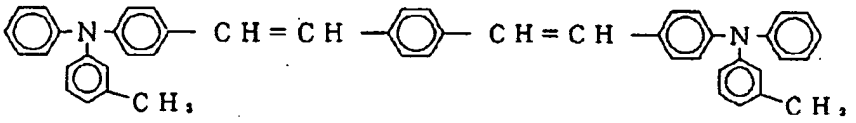
【化４８】

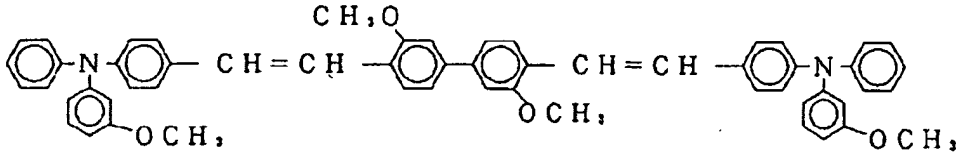
73 74

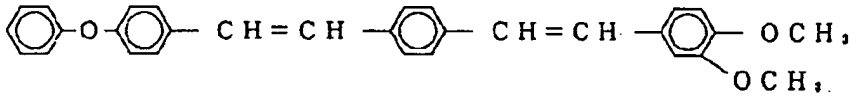


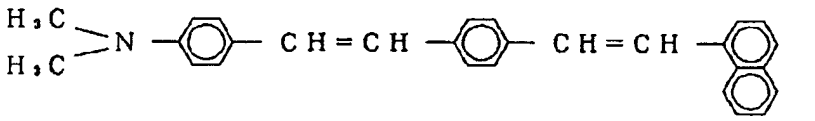








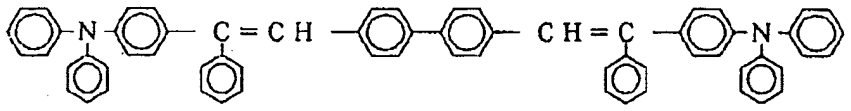


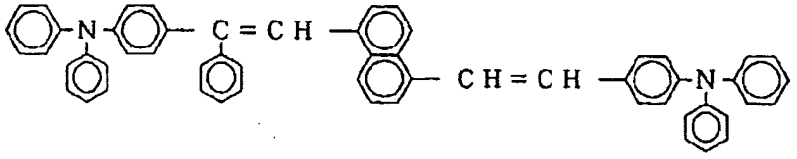


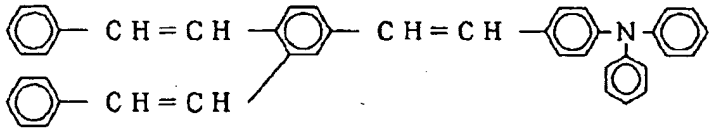
【００８７】

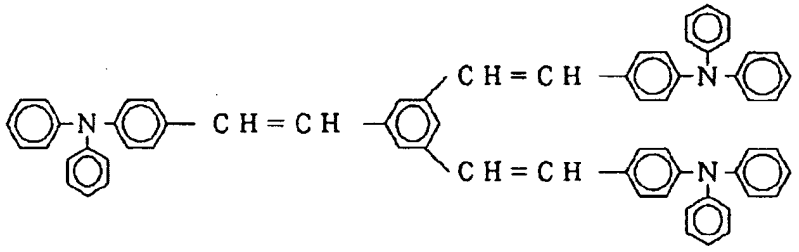
【化４９】

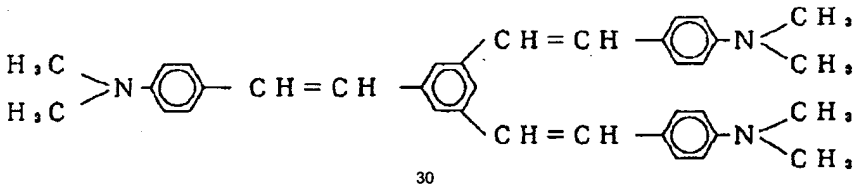
75 76







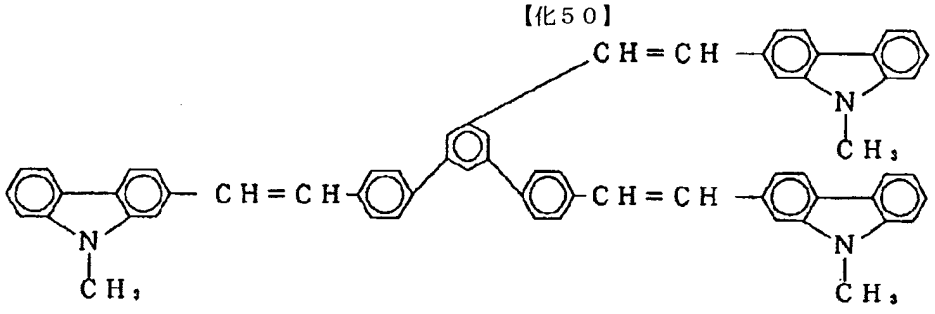


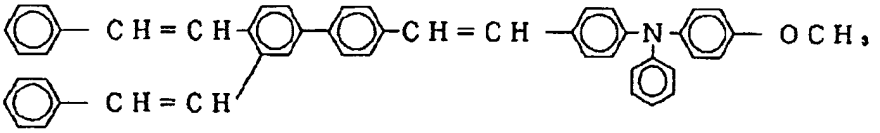


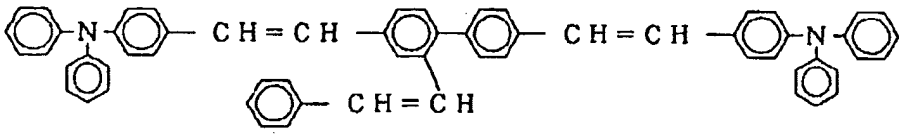
30

【００８８】

【化５０】





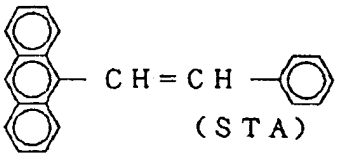


50

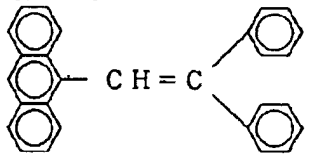
77 78

【００８９】

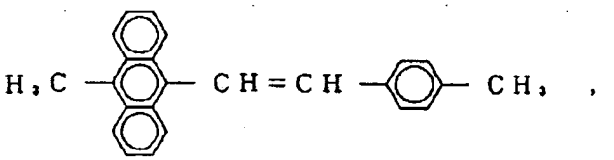
【化５１】



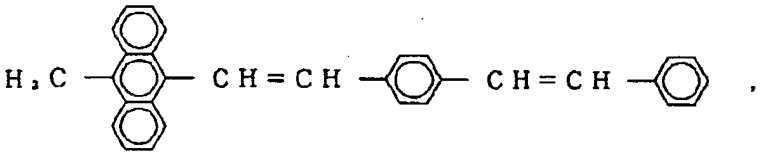
（ＳＴＡ），



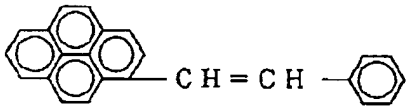
，



，

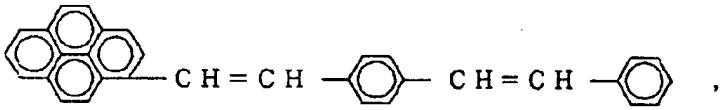


，



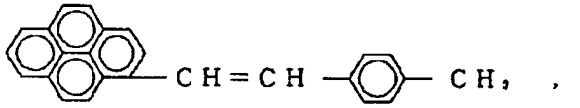
，

（ＳＴＰｙ）



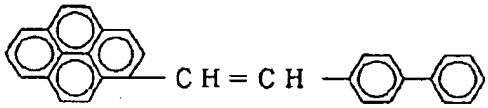
，

（ＳＴＳＴＰｙ）



，

（ＭｅＳＴＰｙ）

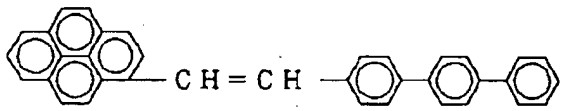


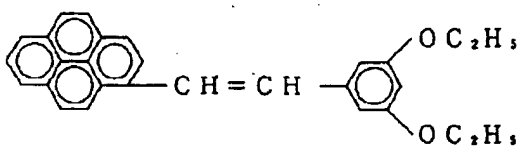
，

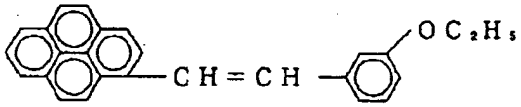
【００９０】

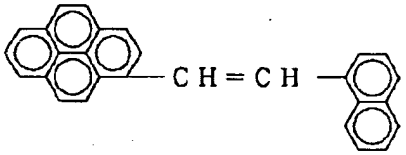
【化５２】

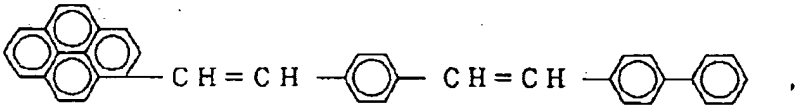
79 80

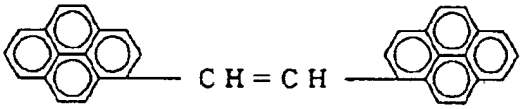


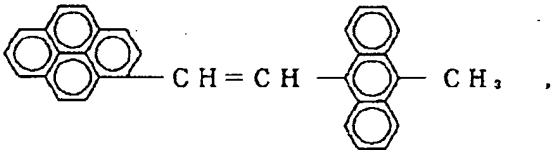








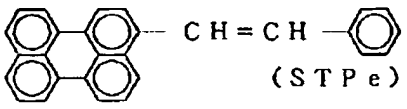




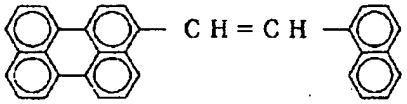
【００９１】

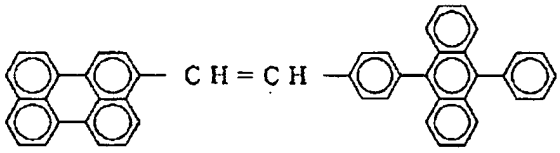
【化５３】

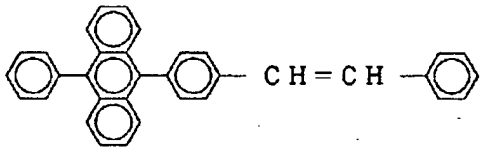
81　　82



（ＳＴＰｅ）





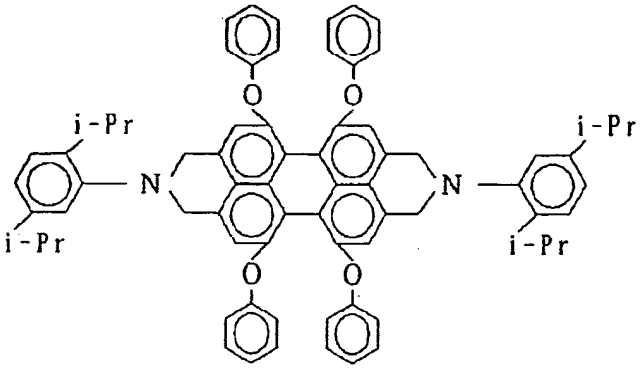


【００９２】などを挙げることができる。

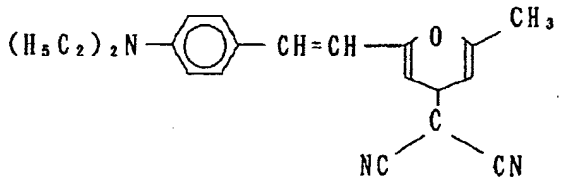
【００９３】本発明の白色有機ＥＬ素子においては、溶液状態での蛍光ピーク波長が５８０ｎｍ以上６５０ｎｍ以下である有機化合物を、前記第一発光層，第二発光層及びその他の有機化合物層の中から選ばれた少なくとも一層に含有させることが必要である。この有機化合物としては、溶液状態でのピーク波長が５８０ｎｍ以上６５０ｎｍ以下であればよく、特に制限はないが、例えばヨーロッパ公開特許第０２８１３８１号公報に記載されている赤色発進レーザー色素として用いられるジシアノメチレンピラン誘導体，ジシアノメチレンチオピラン誘導体，フルオレセイン誘導体，ペリレン誘導体などが挙げられる。具体的には

【００９４】

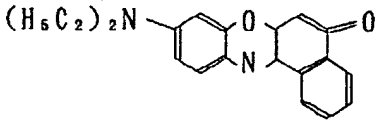
【化５４】



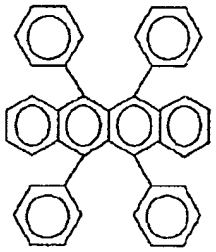
（ルモゲンＦレッド）



（ジシアノメチレンピラン）



（フェノキサゾン）



（ルブレン）

【００９５】などが挙げられる。これらの有機化合物は、層を形成する有機化合物に対して、０.１～１０モル％、好ましくは0.５～５モル％の割合で含有させることが必要である。この0.１～１０％というのは、濃度消光を生じないための濃度範囲である。

【００９６】本発明の白色有機ＥＬ素子の構成は、発光層の構成以外は限定されるものではなく任意の素子構成を採ることができる。具体的に、陽極／正孔注入輸送層／発光層／電子注入輸送層／陰極からなる有機ＥＬ素子の各構成について説明する。

【００９７】本発明の白色有機ＥＬ素子は、支持基板上にて形成することが好ましい。用いられる支持基板は、透明性を有するものが好ましく、一般にガラス，透明プラスチック，石英などである。本発明の白色有機ＥＬ素子における陽極としては、仕事関数の大きい（４ｅＶ以上）金属，合金，電気伝導性化合物及びこれらの混合物を電極物質とするものが好ましく用いられる。このような電極物質の具体例としては、Ａｕなどの金属，ＣｕＩ，ＩＴＯ，SnO_2，ＺｎＯなどの誘電性を有した透明材料又は半透明材料が挙げられる。該陽極は、これらの極物質を蒸着やスパッタリングなどの方法により、薄膜を形成させることにより作製することができる。この電極より発光を取り出す場合には、透過率を１０％より大きくすることが望ましく、また、電極としてのシート抵抗は数百Ω／□以下が好ましい。さらに膜厚は材料にもよるが、通常１０ｎｍ～１μｍ、好ましくは１０～２００ｎｍの範囲で選ばれる。

【００９８】一方、陰極としては、仕事関数の小さい

（４ｅＶ以下）金属，合金，電気伝導性化合物及びこれらの混合物を電極物質とするものが用いられる。このような電極物質の具体例としては、ナトリウム，ナトリウムーカリウム合金，マグネシウム，リチウム，マグネシウム／銅混合物，Ａｌ／（Al_2O_3），インジウム，希土類金属などが挙げられる。該陰極は、これらの電極物質を蒸着やスパッタリングなどの方法により、薄膜を形成させることにより、作製することができる。また、電極としてのシート抵抗は数百Ω／□以下が好ましく、膜厚は通常１０ｎｍ～１μｍ、好ましくは５０～２００ｎｍの範囲で選ばれる。なお、このＥＬ素子においては、該陽極又は陰極のいずれか一方が透明又は半透明であることが、発光を透過するため、発光の取出し効率がよく好都合である。

【００９９】このＥＬ素子における発光層は、上記第一発光層と第二発光層からなり、かつ第一発光層、第二発光層の順に透明電極又は陽極側から順次積層された積層構造を有している。特に、陰極側に近い発光層が遠い発光層より電子輸送能力が大であることが好ましい。これは、二つの発光層界面で主たる発光が生じ、ここでの発光もしくは励起状態のエネルギーを利用し、液体状態での蛍光ピークが５８０ｎｍ以上６５０ｎｍ以下である有機化合物が発光し、透明電極から白色発光を取り出させる。第一発光層と第二発光層の積層順が逆になった場合、第一発光層の発光が第二発光層に吸収され、良好な白色が得られなくなる。液体状態での蛍光ピークが５８０ｎｍ以上６５０ｎｍ以下である有機化合物は、発光波長では長波長成分であるので、他の成分により吸収されることはなく、有機化合物層のいかなる層に含有させてもよい。そして、発光層の厚さは、好ましくは第二発光層が第一発光層の膜厚以上であればよく、この範囲で適宜状況に応じて選ぶことができる。上記発光層の形成方法は、限定されることはなく、例えば蒸着法，スピンコート法，キャスト法，ＬＢ法などの公知の方法により薄膜化することにより形成することができるが、特に分子堆積膜であることが好ましい。ここで、分子堆積膜とは、該化合物の気相状態から沈着され形成された薄膜や、該化合物の溶液状態又は液相状態から固体化され形成された膜のことであり、通常この分子堆積膜はＬＢ法により形成された薄膜（分子累積膜）とは、凝集構造，高次構造の相違や、それに起因する機能的な相違により区分することができる。

【０１００】このように本発明における発光層は、電界印加時に、陽極又は正孔注入輸送層より正孔を注入することができ、かつ陰極又は電子注入輸送層より電子を注入することができる注入機能、注入した電荷（電子と正孔）を電界の力で移動させる輸送機能、電子と正孔の再結合の場を提供し、これを発光につなげる発光機能などを有している。本発明の発光層とは、可視光を発光する層のことである。なお、正孔の注入されやすさと、電子の注入されやすさには違いがあっても構わない。また、正孔と電子の移動度で表される輸送機能に大小があってもよいが、どちらか一方を移動することが好ましい。さらに、本発明で用いられる発光材料は、他の有機化合物層内において再結合した電荷による励起状態の供給をうけて発光してもよい。次に、本発明のＥＬ素子における正孔注入輸送層は、必ずしも該素子に必要なものではないが、発光性能の向上のため用いた方が好ましいものである。この正孔注入輸送層としては、より低い電界で正孔を発光層に輸送する材料が好ましく、さらに正孔の移動度が10^4～10^6ボルト／ｃｍの電場で少なくとも10^{-6} cm^2／ボルト・秒であれば尚好ましい。例えば、従来、光導伝材料において、正孔の電荷注入輸送材料として慣用されているものやＥＬ素子の正孔注入輸送層に使用される公知のものの中から任意のものを選択して用いることができる。

【０１０１】正孔注入輸送層としては、例えばトリアゾール誘導体（米国特許第3,112,197号明細書等参照），オキサジアゾール誘導体（米国特許第3,189,447 号明細書等参照），イミダゾール誘導体（特公昭３７－１６０９６号公報等参照），ポリアリールアルカン誘導体（米国特許第3,615,402 号明細書，同3,820,989 号明細書，同3,542,544 号明細書，特公昭４５－５５５号公報，同５１－１０９８３号公報，特開昭５１－９３２２４号公報，同５５－１７１０５号公報，同５６－４１４８号公報，同５５－１０８６６７号公報，同５５－１５６９５３号公報，同５６－３６６５６号公報等参照），ピラゾリン誘導体及びピラゾロン誘導体（米国特許第3,180,729 号明細書，同4,278,746 号明細書，特開昭５５－８８０６４号公報，同５５－８８０６５号公報，同４９－１０５５３７号公報，同５５－５１０８６号公報，同５６－８００５１号公報，同５６－８８１４１号公報，同５７－４５５４５号公報，同５４－１１２６３７号公報，同５５－７４５４６号公報等参照），フェニレンジアミン誘導体（米国特許第3,615,404 号明細書，特公昭５１－１０１０５号公報，同４６－３７１２号公報，同４７－２５３３６号公報，特開昭５４－５３４３５号公報，同５４－１１０５３６号公報，同５４－１１９９２５号公報等参照），アリールアミン誘導体（米国特許第3,567,450 号明細書，同3,180,703 号明細書，同3,240,597 号明細書，同3,658,520 号明細書，同4,232,103 号明細書，同4,175,961 号明細書，同4,012,376 号明細書，特公昭４９－３５７０２号公報，同３９－２７５７７号公報，特開昭５５－１４４２５０号公報，同５６－１１９１３２号公報，同５６－２２４３７号公報，西独特許第1,110,518 号明細書等参照），アミノ置換カルコン誘導体（米国特許第3,526,501 号明細書等参照），オキサゾール誘導体（米国特許第3,257,203 号明細書などに記載のもの），スチリルアントラセン誘導体（特開昭５６－４６２３４号公報等参照），フルオレノン誘導体（特開

昭５４－１１０８３７号公報等参照），ヒドラゾン誘導体（米国特許第3,717,462 号明細書，特開昭５４－５９１４３号公報，同５５－５２０６３号公報，同５５－５２０６４号公報，同５５－４６７６０号公報，同５５－８５４９５号公報，同５７－１１３５０号公報，同５７－１４８７４９号公報，特開平２－３１１５９１号公報等参照），スチルベン誘導体（特開昭６１－２１０３６３号公報，同６１－２２８４５１号公報，同６１－１４６４２号公報，同６１－７２２５５号公報，同６２－４７６４６号公報，同６２－３６６７４号公報，同６２－１０６５２号公報，同６２－３０２５５号公報，同６０－９３４４５号公報，同６０－９４４６２号公報，同６０－１７４７４９号公報，同６０－１７５０５２号公報等参照）などを挙げることができる。さらに、シラザン誘導体（米国特許第４９５０９５０号明細書），ポリシラン系（特開平２－２０４９９６号公報），アニリン系共重合体（特開平２－２８２２６３号公報）、また特願平１－２１１３９９号明細書で示された導電性高分子オリゴマー、特にチオフェンオリゴマーなどが挙げられる。

【０１０２】本発明においては、これらの化合物を正孔注入輸送層の材料として使用することができるが、次に示すポルフィリン化合物（特開昭６３－２９５６９６５号公報などに記載のもの）及び芳香族第三級アミン化合物及びスチリルアミン化合物（米国特許第4,127,412 号明細書，特開昭５３－２７０３３号公報，同５４－５８４４５号公報，同５４－１４９６３４号公報，同５４－６４２９９号公報，同５５－７９４５０号公報，同５５－１４４２５０号公報，同５６－１１９１３２号公報，同６１－２９５５５８号公報，同６１－９８３５３号公報，同６３－２９５６９５号公報等参照），特に該芳香族第三級アミン化合物を用いることが好ましい。

【０１０３】該ポルフィリン化合物の代表例としては、ポルフィン；１，１０，１５，２０－テトラフェニル－２１Ｈ，２３Ｈ－ポルフィン銅（II）；１，１０，１５，２０－テトラフェニル２１Ｈ，２３Ｈ－ポルフィン亜鉛（II）；５，１０，１５，２０－テトラキス（ペンタフルオロフェニル）－２１Ｈ，２３Ｈ－ポルフィン；シリコンフタロシアニンオキシド；アルミニウムフタロシアニンクロリド；フタロシアニン（無金属）；ジリチウムフタロシアニン；銅テトラメチルフタロシアニン；銅フタロシアニン；クロムフタロシアニン；亜鉛フタロシアニン；鉛フタロシアニン；チタニウムフタロシアニンオキシド；マグネシウムフタロシアニン；銅オクタメチルフタロシアニンなどが挙げられる。また、該芳香族第三級アミン化合物及びスチリルアミン化合物の代表例としては、Ｎ，Ｎ，Ｎ’，Ｎ’－テトラフェニル－４，４’－ジアミノフェニル；Ｎ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ジ（３－メチルフェニル）－４，４’－ジアミノビフェニル（ＴＰＤＡ）；２，２－ビス（４－ジ－ｐ－トリルアミノフェニル）プロパン；１，１－ビス（４－ジ－ｐ－トリルアミノフェニル）シクロヘキサン；Ｎ，Ｎ，Ｎ’，Ｎ’－テトラ－ｐ－トリル－４，４’－ジアミノビフェニル；１，１－ビス（４－ジ－ｐ－トリルアミノフェニル）－４－フェニルシクロヘキサン；ビス（４－ジメチルアミノ－２－メチルフェニル）フェニルメタン；ビス（４－ジ－ｐ－トリルアミノフェニル）フェニルメタン；Ｎ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ジ（４－メトキシフェニル）－４，４’－ジアミノビフェニル；Ｎ，Ｎ，Ｎ’，Ｎ’－テトラフェニル－４，４’－ジアミノジフェニルエーテル；４，４’－ビス（ジフェニルアミノ）クオードリフェニル；Ｎ，Ｎ，Ｎ－トリ（ｐ－トリル）アミン；４－（ジ－ｐ－トリルアミノ）－４’－〔４（ジ－ｐ－トリルアミノ）スチリル〕スチルベン；４－Ｎ，Ｎ－ジフェニルアミノ－（２－ジフェニルビニル）ベンゼン；３－メトキシ－４’－Ｎ，Ｎ－ジフェニルアミノスチルベンゼン；Ｎ－フェニルカルバゾール；芳香族ジメチリディン系化合物などが挙げられる。また、発光層の材料として示した芳香族メチリジン化合物（特願平２－２７９３０４号明細書および特開平３－２３１９７０号公報参照）も、正孔注入輸送層の材料として用いることができる。さらに、ｐ型－Ｓｉ，ｐ型－ＳｉＣなどの無機化合物（国際公開特許ＷＯ９０－０５９９８号公報参照）も、正孔注入輸送層の材料として用いることができる。

【０１０４】本発明のＥＬ素子における正孔注入輸送層は、上記化合物を、例えば真空蒸着法，スピンコート法，キャスト法，ＬＢ法等の公知の薄膜化法により製膜して形成することができる。この正孔注入輸送層としての膜厚は、特に制限はないが、通常は１ｎｍ～１０μｍ、好ましくは５ｎｍ～５μｍである。この正孔注入輸送層は、これらの正孔注入輸送材料一種又は二種以上からなる一層で構成されてもよいし、あるいは、前記正孔注入輸送層とは別種の化合物からなる正孔注入輸送層を積層したものであってもよい。

【０１０５】本発明の白色有機ＥＬ素子においては、発光層と陰極間の付着性を向上させるために、該電子注入輸送層は、発光層及び陰極に対し付着性の高い材料を含有するのが好ましい。この様な付着性の高い材料としては、ニトロ置換フルオレノン誘導体，アントラキノジメタン誘導体，ジフェニルキノン誘導体，チオピランジオキシド誘導体，ナフタレンペリレン誘導体などの複素環テトラカルボン酸無水物，カルボジイミド，フルオレニリデンメタン誘導体，アントラキノジメタン誘導体およびアントロン誘導体，オキサジアゾール誘導体，その他特定の電子伝達性化合物などを挙げることができる。また、８－ヒドロキシキノリン又はその誘導体の金属錯体（Ａｌ，Ｚｎ，Ｌｉ，Ｇａ，Ｂｅ，Ｉｎ，Ｍｇ，Ｃｕ，Ｃａ，ＳｎまたはＰｂ）を挙げることができる。具体的には、オキシン（一般に８－キノリノールまたは８－ヒ

ドロキシキノリン）のキレートを含む金属キレートオキシノイド化合物である。このような化合物は高水準の性能を示し、容易に薄膜形態に成形される。

【０１０６】さらに、具体的にキレート化オキシノイド化合物を例示すると、トリス（８－キノリノール）アルミニウム；ビス（８－キノリノール）マグネシウム；ビス（ベンゾ－８－キノリノール）亜鉛；ビス（２－メチル－８－キノリラート）アルミニウムオキシド；トリス（８－キノリノール）インジウム；トリス（５－メチル－８－キノリノール）アルミニウム；８－キノリノールリチウム；トリス（５－クロロ－８－キノリノール）ガリウム；ビス（５－クロロ－８－キノリノール）カルシウム；５，７－ジクロル－８－キノリノールアルミニウム；トリス（５，７－ジブロモ－８－ヒドロキシキノリノール）アルミニウム等がある。その他に、メタルフリーあるいはメタルフタロシアニン、それらの末端がアルキル基またはスルホン基で置換されているものも好ましい。さらに、発光層の材料として前述したジスチリルピラジン誘導体も電子注入輸送層の材料として用いることができる。さらに、ｐ型－Ｓｉ，ｐ型－ＳｉＣなどの無機化合物（国際公開特許ＷＯ９０－０５９９８号公報参照）も、電子注入輸送層の材料として用いることができる。

【０１０７】本発明のＥＬ素子における電子注入輸送層は、上記化合物を、例えば真空蒸着法，スピンコート法，キャスト法，ＬＢ法等の公知の薄膜化法により製膜して形成することができる。この電子注入輸送層としての膜厚は、特に制限はないが、通常は１ｎｍ～１０μｍ、好ましくは５ｎｍ～５μｍである。この電子注入輸送層は、これらの電子注入輸送材料一種又は二種以上からなる一層で構成されてもよいし、あるいは、前記電子注入輸送層とは別種の化合物からなる電子注入輸送層を積層したものであってもよい。

【０１０８】

【実施例】次に、実施例により本発明をさらに詳しく説明するが、本発明はこれらの例によってなんら限定されるものではない。

実施例１～３

２５ｍｍ×７５ｍｍ×1.１ｍｍのガラス基板上にＩＴＯを蒸着法にて１００ｎｍの膜厚で製造したものを透明電極基板とした。この基板をイソプロピルアルコール中にて１０分間超音波洗浄を行い、浸漬した。この基板を乾燥窒素中にて乾燥し、次いで、ＵＶオゾン洗浄を（株）サムコインターナショナル研究所製の装置（ＵＶ－３００）にて行い、透明電極基板とした。この透明電極基板を市販の蒸着装置（日本真空技術（株）製）の基板ホルダーに設置し、モリブデン製抵抗加熱ボートにＮ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ビス（３－メチルフェニル）－〔１，１’－ビフェニル〕－４，４’－ジアミン（ＴＰＤ）を２００ｍｇ入れ、更に、別のモリブデン製抵抗加熱ボートに４，４’－ビス（２，２’－ジフェニルビニル）ビフェニル（ＤＰＶＢｉ）を２００ｍｇ入れ、さらに、別のモリブデン製抵抗加熱ボートに第１表に示す化合物（Ａ）を入れ、真空槽を１×１０$^{-4}$Ｐａまで減圧した。その後、ＴＰＤ入りボートを２１５～２２０℃まで加熱し、ＴＰＤを蒸着速度0.１～0.３ｎｍ／秒で透明支持基板上に蒸着して、膜厚６０ｎｍの正孔注入輸送層を製膜した。このときの基板温度は室温であった。

【０１０９】次に、これを取り出すことなく、この正孔注入輸送層の上に、ＤＰＶＢｉの入ったボートを加熱して第一発光層として４０ｎｍ積層蒸着した。このとき、同時に化合物（Ａ）のボートを加熱し、第一発光層に化合物（Ａ）を第１表に示す（ｂ）モル％の割合で含有させた。その後、真空槽を大気圧に戻し、新たにモリブデン製抵抗加熱ボートに８－ヒドロキシキノリン・アルミニウム錯体（Ａｌｑ）を２００ｍｇ入れ、さらに別のモリブデン製抵抗加熱ボートに第１表に示す化合物（Ｃ）を入れ、再度、真空槽を１×１０$^{-4}$Ｐａまで減圧した。次いでＡｌｑ入りのボートを加熱し、第二発光層として、２０ｎｍ製膜した。このとき、同時に化合物（Ｃ）のボートも加熱し、化合物（Ｃ）を第１表に示す（ｄ）モル％の割合で、第二発光層に含有させた。その後、真空槽を大気圧へ再度戻し、モリブデン製抵抗加熱ボートにマグネシウムリボンを１ｇ入れ、タングステンバスケットに銀ワイヤーを５００ｍｇ入れて、真空槽を１×１０$^{-4}$Ｐａまで減圧した。この後、マグネシウムを蒸着速度1.４ｎｍ／秒、銀を蒸着速度0.１ｎｍ／秒で膜厚１５０ｎｍ同時蒸着し、混合金属からなる陰極とした。

【０１１０】

【表１】

第　１　表

	（A） 化合物の種類	（b） （A）の含有量 （モル%）	（C） 化合物の種類	（d） （C）の含有量 （モル%）
実施例１	ＰＡＶＢｉ	3.0	ルブレン*	0.5
実施例２	ＰＡＶＴＰ	3.0	ルブレン	0.5
実施例３	ＰＡＶＢｉ	3.0	ルモルゲンＦ	3.0

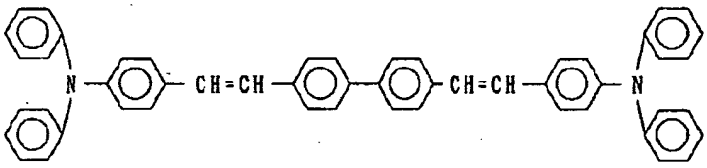
＊：アルドリッチ社製

【０１１１】なお、各有機化合物の蛍光ピーク波長は、ＤＰＶＢｉ（固体）：４６５ｎｍ、ＰＡＶＢｉ（固体）：４６３ｎｍ、ＰＡＶＴＰ（固体）：４５４ｎｍ、Ａｌｑ（固体）：５００ｎｍ、ルブレン（ジメチルホルムアミド0.１重量%溶液）：５８５ｎｍ及びルモゲンＦ（ジメチルホルムアミド0.１重量%溶液）：５９５ｎｍであった。また、ＰＡＶＢｉ及びＰＡＶＴＰの構造式を次に示す。

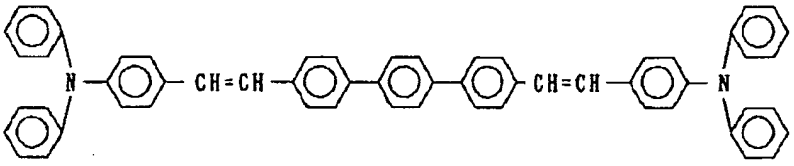
【０１１２】

【化５５】

ＰＡＶＢｉ



ＰＡＶＴＰ



【０１１３】この素子の初期性能の代表値及び半減寿命を求めた。その結果を第２表に示す。なお、半減寿命は、初期輝度：１００ｃｄ／ｍ^2、直流定電流駆動及び駆動環境：乾燥窒素雰囲気の条件で測定を行い、初期輝度の１／２に達した時間で表した。

【０１１４】実施例４

実施例１～３と同じ形状のＩＴＯ付きガラス基板に同じ洗浄工程を施し、透明電極基板とし、真空槽の基板ホルダーに設置した。モリブデン製抵抗加熱ボートにＴＰＤを２００ｍｇ入れ、さらに、別のモリブデン製抵抗加熱ボートにルブレンを入れ、真空槽を１×１０$^{-4}$Ｐａまで減圧した。その後、ＴＰＤ入りボートを加熱し、ＴＰＤを蒸着速度２９～３０ｎｍ／秒で透明支持基板上に蒸着して、膜厚６０ｎｍの正孔注入輸送層を製膜した。これと同時にルブレンの入ったボートを加熱し、0.５モル%の割合で正孔注入輸送層にルブレンを含有させた。このときの基板温度は室温であった。この後、一度大気圧に戻し、別のモリブデン製抵抗加熱ボートにＤＰＶＢｉを２００ｍｇ入れ、さらに、別のモリブデン製ボートに化合物ＰＡＶＢｉを入れ、真空槽を１×１０$^{-4}$Ｐａまで減圧し、該正孔注入輸送層上に、第一発光層としてＤＰＶＢｉを４０ｎｍ積層した。同時に、ＰＡＶＢｉの入ったボートを加熱し、この第一発光層にＰＡＶＢｉを３モル%の割合で含有させた。この後、大気圧に戻し、新たにモリブデン製抵抗加熱ボートにＡｌｑを２００ｍｇ入れ、モリブデン製抵抗加熱ボートにマグネシウムリボンを１ｇ入れ、さらにタングステンバスケットに銀ワイヤーを５００ｍｇ入れて、真空槽を１×１０$^{-4}$Ｐａまで減圧し、Ａｌｑを第二発光層として、４０ｎｍ製膜した。この後、マグネシウムを蒸着速度1.４ｎｍ／秒、銀を蒸

着速度0.１ｎｍ／秒で膜厚１５０ｎｍ同時蒸着し、混合金属からなる陰極とした。この素子の初期性能の代表値及び半減寿命を、実施例１～３と同様に求めた。その結果を第２表に示す。

【０１１５】実施例５

実施例１～３と同じ形状のＩＴＯ付きガラス基板に同じ洗浄工程を施し、透明電極基板とし、真空槽の基板ホルダーに設置した。モリブデン製抵抗加熱ボートにＴＰＤを２００ｍｇ入れ、さらに別のモリブデン製抵抗加熱ボートにＤＰＶＢｉを２００ｍｇ入れて真空槽を１×１０$^{-4}$Ｐａまで減圧した。その後、ＴＰＤ入りボートを２１５～２２０℃に加熱し、ＴＰＤを蒸着速度0.１～0.３ｎｍ／秒で透明支持基板上に蒸着して、膜厚６０ｎｍの正孔注入輸送層を製膜させた。この時の基板温度は室温であった。これを真空槽より取り出すことなく、正孔注入輸送層の上に、ＤＰＶＢｉの入ったボートを２４５℃に加熱し、第一発光層として４０ｎｍ積層蒸着した。その後、真空槽を大気圧に戻し、新たにモリブデン製の抵抗加熱ボートにＡｌｑを２００ｍｇ入れて、さらに別のモリブデン製抵抗加熱ボートにルモゲンＦレッド（バフス社製）を入れ、再度真空槽を１×１０$^{-4}$Ｐａまで減圧した。次いで、ルモゲンＦレッド入りのモリブデン製抵抗加熱ボートを３３０℃に加熱し、Ａｌｑ入りのモリブデン製ボートを２５０℃まで加熱し、ルモゲンＦレッドの含有量がＡｌｑに対して３モル％になるように、第二発光層４０ｎｍを製膜した。その後、真空槽を大気圧に戻し、モリブデン製抵抗加熱ボートにマグネシウムを１ｇ入れ、タングステン製バスケットに銀ワイヤーを５００ｍｇ入れ、その後、真空槽を１×１０$^{-4}$Ｐａまで減圧し、マグネシウムを蒸着速度1.４ｎｍ／秒、銀を蒸着速度0.１ｎｍ／秒で膜厚１５０ｎｍ同時蒸着し、混合金属からなる陰極とした。この素子の初期性能の代表値及び半減寿命を実施例１～３と同様に求めた。その結果を第２表に示す。

【０１１６】

【表２】

第　２　表－１

	初期性能			
	電圧（Ｖ）	電流密度（mA/cm^2）	発光輝度（cd/m^2）	発光効率（lm/W）
実施例１	9.5	4.５	１００	0.７
実施例２	9.５	5.０	１００	0.７
実施例３	10.０	7.０	１００	0.４
実施例４	11.０	6.５	１００	0.４
実施例５	9.８	7.５	１００	0.４

【０１１７】

【表３】

第　２　表－２

	ＣＩＥ色度座標（ｘ，ｙ）	半減時間（時間）
実施例１	(0.245，0.278)	１，０００
実施例２	(0.245，0.267)	８００
実施例３	(0.300，0.320)	６００
実施例４	(0.265，0.278)	３００
実施例５	(0.220，0.240)	２００

【０１１８】第２表から分かるように、実施例１～４は、実施例５に比べて発光色の白色化及び量子収率（輝度／電流密度に相当）が向上しており、また発光安定性も向上している。

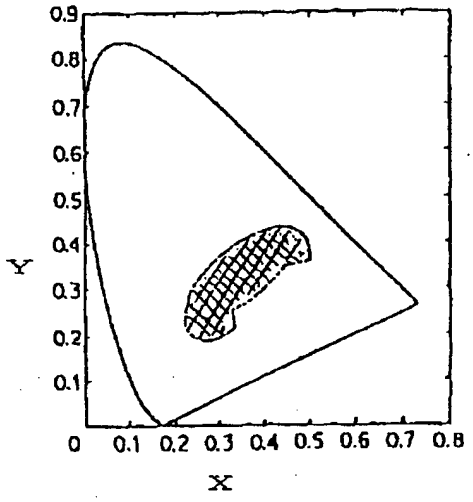
【０１１９】

【発明の効果】本発明の白色有機ＥＬ素子は、発光効率が高く、かつ発光安定性に優れた白色発光を呈し、各種表示装置における発光素子として好適に用いられる。

【図面の簡単な説明】

【図１】　図１は、ＣＩＥ色度座標における白色光の定義領域を表したグラフである。

【図１】



▨：ＣＩＥ座標における白色発光領域を示す。

フロントページの続き

(72)発明者　東　久洋
千葉県袖ケ浦市上泉1280番地　出光興産株式会社内
(72)発明者　楠本　正
千葉県袖ケ浦市上泉1280番地　出光興産株式会社内

(56)参考文献　特開　平２－261889（ＪＰ，Ａ）
特開　昭59－56391（ＪＰ，Ａ）
特開　平４－284395（ＪＰ，Ａ）
特開　平２－216790（ＪＰ，Ａ）
特開　平３－230584（ＪＰ，Ａ）
特開　平４－184892（ＪＰ，Ａ）
特開　平３－33184（ＪＰ，Ａ）
特開　平３－223387（ＪＰ，Ａ）

(58)調査した分野(Int.Cl.[7]，ＤＢ名)
H05B　33/10 - 33/28

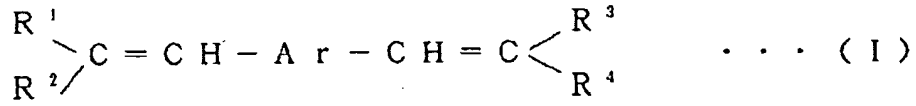
CLAIMS

(57) [Claim(s)]

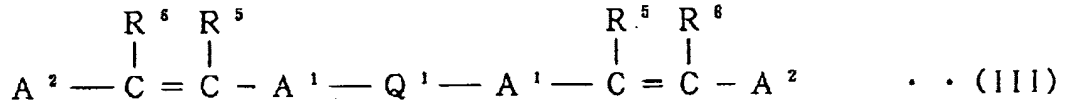
[Claim 1] In the organic electroluminescent element which comes to pinch the organic compound layer to which at least one side contains a luminous layer in inter-electrode [of a transparent or translucent couple] at least The first luminous layer in which, as for this luminous layer, the fluorescence peak wavelength of a solid state contains 380nm or more organic compound it is [organic compound] less than 480nm, The second luminous layer in which the fluorescence peak wavelength of a solid state contains 480nm or more organic compound it is [organic compound] less than 580nm consists of a laminated structure by which the laminating was carried out one by one from the transparent-electrode or anode plate side. The fluorescence peak wavelength in a solution state and 580nm or more organic compound it is [organic compound] 650nm or less White organic electroluminescent element characterized by making a monostromatic contain at 0.1-10-mol % of a rate to the organic compound which was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers, and which forms the layer at least.

[Claim 2] In the organic electroluminescent element which comes to pinch the organic compound layer to which at least one side contains a luminous layer in inter-electrode [of a transparent or translucent couple] at least The first luminous layer in which, as for this luminous layer, the fluorescence peak wavelength of a solid state contains 380nm or more organic compound it is [organic compound] less than 480nm, The second luminous layer in which the fluorescence peak wavelength of a solid state contains 480nm or more organic compound it is [organic compound] less than 580nm consists of a laminated structure by which the laminating was carried out one by one from the transparent-electrode or anode plate side. RUMOGEN F red, a dicyanomethylene pyran, FENOKIZOSAN, rubrene, A dicyanomethylene pyran derivative, a dicyanomethylene thiopyran derivative, At least one kind of organic compound chosen from a fluorescein derivative and a perylene derivative White organic electroluminescent element characterized by making a monostromatic contain at 0.1-10-mol % of a rate to the organic compound which was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers, and which forms the layer at least. [Claim 3] In the organic electroluminescent element which comes to pinch the organic compound layer to which at least one side contains a luminous layer in inter-electrode [of a transparent or translucent couple] at least The first luminous layer in which, as for this luminous layer, the fluorescence peak wavelength of a solid state contains 380nm or more organic compound it is [organic compound] less than 480nm, The second luminous layer in which the fluorescence peak wavelength of a solid state contains 480nm or more organic compound it is [organic compound] less than 580nm consists of a laminated structure by which the laminating was carried out one by one from the transparent-electrode or anode plate side. The organic compound whose fluorescence of a solution state is a red system And the first luminous layer of the above, White organic electroluminescent element characterized by making a monostromatic contain at 0.1-10-mol % of a rate to the organic compound which was chosen from the second luminous layer and other organic compound layers, and which forms the layer at least. [Claim 4] The organic compound whose fluorescence peak wavelength of a solid state is 380nm or more less than 480nm is a general

formula (I). [Formula 1]

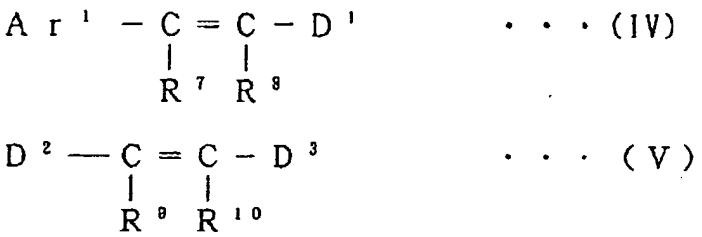


R1 -R4 shows among [formula the aryloxy group of the carbon numbers 6-18 which are not replaced [the cyclohexyl machine which is not replaced / the aromatic heterocycle formula machine which is not replaced / the aryl group of the carbon numbers 6-18 which are not replaced / a hydrogen atom, the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or /, substitution, or /, substitution, or /, substitution, or], respectively. Here, a substituent shows the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, the aryloxy group of carbon numbers 6-18, the acyl group of carbon numbers 1-6, the acyloxy machine of carbon numbers 1-6, a carboxyl group, a styryl machine, the aryl carbonyl group of carbon numbers 6-20, the aryloxy carbonyl group of carbon numbers 6-20, the alkoxy carbonyl group of carbon numbers 1-6, a vinyl group, the Ernie Reno carbonyl group, a carbamoyl group, Even if these substituents are single, plural is sufficient as them. Moreover, R1 -R4 Even if the same, it may differ mutually, and it is R1. R2 And R3 R4 It may combine with the basis replaced mutually and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation substitution, or] or an unsaturation may be formed. Ar expresses the arylene machine of the carbon numbers 6-20 which are not replaced [substitution or], and even if single substitution is carried out, it replaces them -- having -- **** -- moreover, a bonding site -- ORUTO and Para -- meta--- any are sufficient [two or more] In addition, the substituent is the same as the above. Moreover, the substituents of an arylene machine may join together and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation, substitution, or] or an unsaturation may be formed. However, it is R1 -R4 when Ar is a non-replaced phenylene. It is chosen out of the naphthyl group which is not replaced [the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or], a biphenyl machine, a cyclohexyl machine, and an aryloxy group, respectively.] White organic electroluminescent element according to claim 1 to 3 which is the aromatic methylidyne compound come out of and expressed. [Claim 5] The organic compound whose fluorescence peak wavelength of a solid state is 380nm or more less than 480nm is general formula (II) A-Q-B. ... Among (II) [formula, A and B show the monad excluding one hydrogen atom from the compound expressed with the above-mentioned general formula (I), respectively, and even if the same, they may differ. Moreover, Q shows the bivalent machine with which conjugated system is cut.] White organic electroluminescent element according to claim 1 to 3 which is the aromatic methylidyne compound come out of and expressed. [Claim 6] The organic compound whose fluorescence peak wavelength of a solid state is 380nm or more less than 480nm is a general formula (III). [Formula 2]

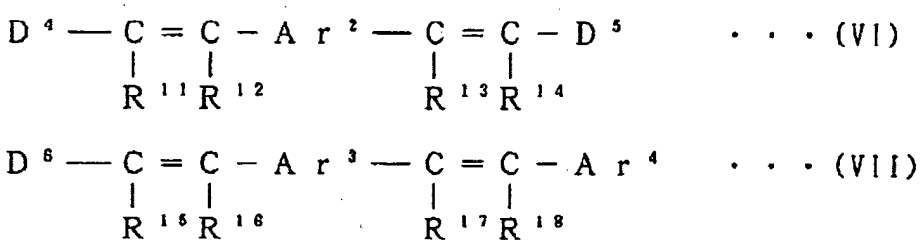


A1 shows among [formula the arylene machine or the bivalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or]. Any of ORUTO, meta, and Para are sufficient as a joint position. A2 The aryl group or the monovalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or] is shown. R5 And R6 The aryl group of the carbon numbers 6-20 which are not replaced [a hydrogen atom, substitution, or], a cyclohexyl machine, a monovalent aromatic heterocycle formula machine, the alkyl group of carbon numbers 1-10, the aralkyl machine of carbon numbers 7-20, or the alkoxy group of carbon numbers 1-10 is shown, respectively. In addition, R5 and R6 You may differ, even if the same. Here, a substituent may

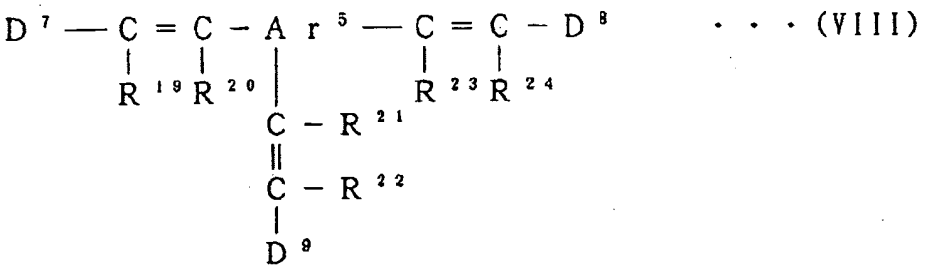
be a phenyl group which it does not have or it has an alkyl group, an aryloxy group, amino groups, or these bases, and even if this substituent is single, plural is sufficient as it. Moreover, R5 Each substituent is A1. It may join together, the five membered ring or six membered ring of saturation or an unsaturation may be formed, and it is R6 similarly. Each substituent is A2. It may join together and the five membered ring or six membered ring of saturation or an unsaturation may be formed. Moreover, Q1 The bivalent machine with which conjugate is cut is expressed.] White organic electroluminescent element according to claim 1 to 3 which is the aromatic methylidyne compound come out of and expressed. [Claim 7] White organic electroluminescent element according to claim 1 to 3 whose organic compound whose fluorescence peak wavelength of a solid state is 480nm or more less than 580nm is the metal complex of 8-hydroxyquinoline or its derivative. [Claim 8] To the first luminous layer and/or the second luminous layer, it is a general formula (IV). It reaches (V). [Formula 3]



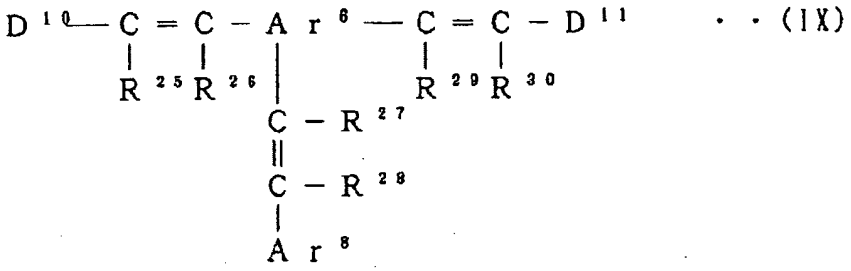
Ar1 shows the aryl group of carbon numbers 6-20 among [formula. R7 -R10 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D1 -D3 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown. Here, Ar1 and R7 -R10 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20.] White organic electroluminescent element according to claim 1 to 3 which came out and was chosen from the stilbene derivatives expressed and which makes it come at least to contain a kind. [Claim 9] General formula (VI) Attain to the first luminous layer and/or the second luminous layer (VII). [Formula 4]



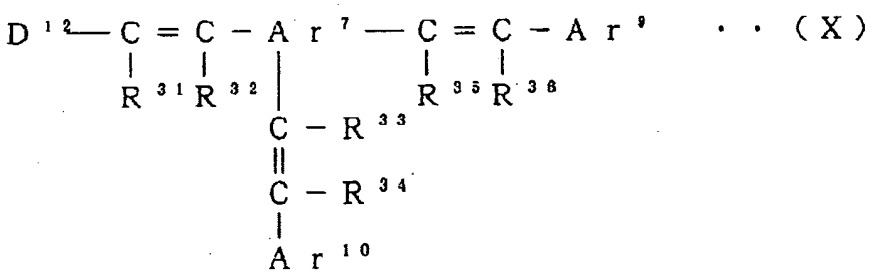
Among [formula, Ar2 and Ar3 show the arylene machine of carbon numbers 6-20 independently, respectively, and Ar4 shows the aryl group of carbon numbers 6-20. R11-R18 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. Here, Ar2 -Ar4, and R11-R18 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the ARARIKIRU machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. D4 -D6 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown.] White organic electroluminescent element according to claim 1 to 3 which came out and was chosen from the JISUCHIRU arylene derivatives expressed and which makes it come at least to contain a kind. [Claim 10] To the first luminous layer and/or the second luminous layer, it is general formula (VIII) - (X). [Formula 5]



・・・(VIII)



・・(IX)



・・(X)

Among [formula, Ar5 -Ar7 shows the trivalent aromatic ring machine of carbon numbers 6-24 independently, respectively, and Ar8 -Ar10 shows the aryl group of carbon numbers 6-20 independently, respectively. R19-R36 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D7 -D12 show the aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively, or the condensation polycyclic group machine of carbon numbers 10-30. Here, Ar5 -Ar7, and R19-R36 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20.] White organic electroluminescent element according to claim 1 to 3 which came out and was chosen from the tris styryl arylene derivatives expressed and which makes it come at least to contain a kind. [Claim 11] White organic electroluminescent element according to claim 1 to 3 whose electronic transport capacity the direction of the luminous layer near a cathode side is size in the first luminous layer and the second luminous layer. [Claim 12] White organic electroluminescent element according to claim 1 to 3 whose thickness of the second luminous layer is more than the thickness of the first luminous layer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Luminous efficiency of this invention is high in more detail about new white organic electroluminescent element, and it is related with the organic electroluminescent element which presents white luminescence excellent in luminescence stability.
[0002]
[Description of the Prior Art] For self-luminescence, visibility of electroluminescent element (EL element) is high, and since it is a perfect solid-state component, it has the feature of excelling in shock resistance. Therefore, various EL elements using inorganic or the organic compound are proposed, and utilization is tried now. Since an organic EL element can reduce applied voltage sharply among these elements, development of various material and elements is furthered. Furthermore, it is effective also in lightweight-izing of display devices, such as a back light, a display, etc. which are used now. About the organic EL element which carries out white luminescence, although the indication of the following technology was made conventionally, there were the following troubles plentifully. For example, in the Europe public presentation patent No. 0390551 official report, in order to incorporate a carrier by tunneling pouring by accumulation of a carrier interface, the threshold-limit-value voltage for carrying out white luminescence exists, and since it is not white, a gradation display is not made to below the threshold limit value. In JP,3-230584,A, since it is mixed luminescence of the fluorescence object of a two color, it does not become good white. although white luminescence is presented in JP,2-220390,A -- applied-voltage 30V -- brightness 110 cd/m2 it is -- a rate with high driver voltage -- luminous efficiency -- low In JP,4-51491,A, it is end-face luminescence structure and is unsuitable for the use as the whole field.
[0003]
[Problem(s) to be Solved by the Invention] While this invention is the basis of such a situation and maintaining the property of the conventional organic EL element, luminous efficiency is high, and it is made for the purpose of offering the organic EL element which presents white luminescence excellent in luminescence stability.
[0004]
[Means for Solving the Problem] As a result of repeating research wholeheartedly that this invention persons should develop the white organic EL element which has high luminous efficiency and luminescence stability, the recombination field of an electron hole and an electron as an interface field of the first luminous layer and the second luminous layer The organic compound in the specific range from which the fluorescence peak wavelength of a solid state differs in the first luminous layer and each second luminous layer is made to contain. And by making a monostromatic contain at least the organic compound which was chosen from the first luminous layer, the second luminous layer, and other organic compound layers and which has the fluorescence peak wavelength in a solution state in the specific range While maintaining the property of the conventional organic EL element, luminous efficiency was high and it found out that the organic EL element which presents white luminescence excellent in luminescence stability was obtained. this invention is completed based on this knowledge. Namely, this invention is set to the organic electroluminescent

element to which at least one side comes to pinch the organic compound layer which contains a luminous layer in inter-electrode [of a transparent or translucent couple] at least. The first luminous layer in which, as for this luminous layer, the fluorescence peak wavelength of a solid state contains 380nm or more organic compound it is [organic compound] less than 480nm, The second luminous layer in which the fluorescence peak wavelength of a solid state contains 480nm or more organic compound it is [organic compound] less than 580nm consists of a laminated structure by which the laminating was carried out one by one from the transparent-electrode or anode plate side. The fluorescence peak wavelength in a solution state and 580nm or more organic compound it is [organic compound] 650nm or less The white organic electroluminescent element characterized by making a monostromatic contain at 0.1-10-mol % of a rate to the organic compound which was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers, and which forms the layer at least is offered.

[0005] The white organic EL element of this invention has the feature in the two-layer luminous layer of the first luminous layer and the second luminous layer. The organic compound 380nm or more less than (blue system) 480nm of whose fluorescence peak wavelengths of a solid state is 420nm or more less than 475nm preferably is used for this first luminous layer, and the organic compound 480nm or more less than (green system) 580nm of whose fluorescence peak wavelengths of a solid state is 490nm or more less than 560nm preferably is used for the second luminous layer at it. Furthermore, fluorescence peak wavelength in a solution state is preferably characterized by % and 580nm or more 650nm or less (red system) of 0.1-10-mol making it contain at 0.5-5-mol % of a rate preferably at a monostromatic to the organic compound which forms the layer for 585nm or more organic compound which is 620nm or less chosen from the above-mentioned luminous layer and other organic compound layers at least. This 0.1-10-mol % is a density range for not producing concentration quenching. In addition, in the fluorescence spectrum, the peak should just have at least one peak in each above-mentioned whole wavelength surface region in the compound which has more than one.

[0006] The white light by the white organic EL element of this invention can be acquired by the superposition (namely, superposition of three-primary-colors luminescence of three kinds of above-mentioned organic compounds which has specific fluorescence peak wavelength) of luminescence from the first luminous layer of the above, the second luminous layer, and a mixed component. In addition, the CIE coordinate showed the definition of the white light to drawing 1 . Here, what satisfies the fluorescence conditions of the first luminous layer of the above in the organic compound which especially the organic compound used for the first luminous layer is not limited, for example, is indicated by JP,3-231970,A or the international public presentation patent WO 92/No. 05131 official report, the Japanese-Patent-Application-No. No. 170354 [five to] specification, and the Japanese-Patent-Application-No. No. 129438 [five to] specification is mentioned. What satisfies the fluorescence conditions of the first luminous layer of the above in the compound used for the combination of what fulfills the fluorescence conditions of the first luminous layer of the above indicated by JP,3-231970,A, the international public presentation patent WO 92/No. 05131 official report, and the Japanese-Patent-Application-No. No. 170345 [five to] specification as a desirable thing, and the suitable compound indicated by the Japanese-Patent-Application-No. No. 129438 [five to] specification, and the hole-injection transporting bed mentioned further later can be mentioned. Next, as a compound which fulfills the fluorescence conditions of the first luminous layer of the above indicated by JP,3-231970,A and the international public presentation patent WO 92/No. 05131 official report, it is a general formula (I).

[0007]

[Formula 6]

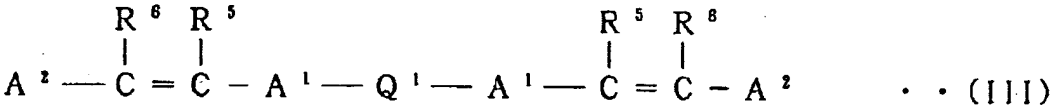
$$R^1 \diagdown C = CH - Ar - CH = C \diagup R^3 \qquad \cdots (I)$$
$$R^2 \diagup \qquad\qquad\qquad\qquad\qquad\qquad R^4$$

[0008] R1 -R4 shows among [formula the pyridyl machine which is not replaced [the aryloxy

group of the carbon numbers 6-18 which are not replaced / the cyclohexyl machine which is not replaced / the aromatic heterocycle formula machine which is not replaced / the aryl group of the carbon numbers 6-18 which are not replaced / a hydrogen atom, the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or /, substitution, or /, substitution, or /, substitution Here, a substituent shows the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, the aryloxy group of carbon numbers 6-18, the acyl group of carbon numbers 1-6, the acyloxy machine of carbon numbers 1-6, a carboxyl group, a styryl machine, the aryl carbonyl group of carbon numbers 6-20, the aryloxy carbonyl group of carbon numbers 6-20, the alkoxy carbonyl group of carbon numbers 1-6, a vinyl group, the Ernie Reno carbonyl group, a carbamoyl group, Even if these substituents are single, plural is sufficient as them. Moreover, R1 -R4 Even if the same, it may differ mutually, and it is R1. R2 And R3 R4 It may combine with the basis replaced mutually and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation substitution, or] or an unsaturation may be formed. Ar expresses the arylene machine of the carbon numbers 6-20 which are not replaced [substitution or], and even if single substitution is carried out, it replaces them -- having -- **** -- moreover, a bonding site -- ORUTO and Para -- meta-- - any are sufficient [two or more] In addition, the substituent is the same as the above. Moreover, the substituents of an arylene machine may join together and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation, substitution, or] or an unsaturation may be formed. However, it is R1 -R4 when Ar is a non-replaced phenylene. It is chosen out of the naphthyl group which is not replaced [the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or], a biphenyl machine, a cyclohexyl machine, and an aryloxy group, respectively.] The aromatic methylidyne compound, general formula (II) which are come out of and expressed

A-Q-B ... Among (II) [formula, A and B show the monad excluding one hydrogen atom from the compound expressed with the above-mentioned general formula (I), respectively, and even if the same, they may differ. Moreover, Q shows the bivalent machine with which conjugated system is cut.] The aromatic methylidyne compound and general formula [0009] which are come out of and expressed (III)

[Formula 7]



$$A^2-C(R^6)=C(R^5)-A^1-Q^1-A^1-C(R^5)=C(R^6)-A^2 \quad \cdots (III)$$

[0010] A1 shows among [formula the arylene machine or the bivalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or]. Any of ORUTO, meta, and Para are sufficient as a joint position. A2 The aryl group or the monovalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or] is shown. R5 And R6 The aryl group of the carbon numbers 6-20 which are not replaced [a hydrogen atom, substitution, or], a cyclohexyl machine, a monovalent aromatic heterocycle formula machine, the alkyl group of carbon numbers 1-10, the aralkyl machine of carbon numbers 7-20, or the alkoxy group of carbon numbers 1-10 is shown, respectively. In addition, R5 and R6 You may differ, even if the same. Here, a substituent may be a phenyl group which it does not have or it has an alkyl group, an aryloxy group, amino groups, or these bases, and even if this substituent is single, plural is sufficient as it. R5 Each substituent is A1. It may join together, the five membered ring or six membered ring of saturation or an unsaturation may be formed, and it is R6 similarly. Each substituent is A2. It may join together and the five membered ring or six membered ring of saturation or an unsaturation may be formed. Moreover, Q1 It is the same as the above.] It comes out and the aromatic methylidyne compound expressed is mentioned.

[0011] here -- R1 -R4 in a general formula (I) You may differ, even if the same like the

above-mentioned. Respectively A hydrogen atom, the alkyl group of carbon numbers 1-6 (a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, a tert-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, iso hexyl machine), The alkoxy group of carbon numbers 1-6 (a methoxy machine, an ethoxy basis, a propoxy group, butoxy machine, etc.), The aralkyl machines (a benzyl, phenethyl machine, etc.) of carbon numbers 7-18, the aryl group of carbon numbers 6-18 (a phenyl group, a biphenyl machine, naphthyl group, etc.), A cyclohexyl machine, an aromatic heterocycle formula machine (a pyridyl machine, quinolyl machine), and the aryloxy groups (a phenoxy machine, a biphenyl oxy-basis, naphthyloxy machine, etc.) of carbon numbers 6-18 are shown.

[0012] Moreover, R1 -R4 What the substituent combined with these may be used. Namely, R1 -R4 A substituent content phenyl group, a substituent content aralkyl machine, a substituent content cyclohexyl machine, a substituent content biphenyl machine, and a substituent content naphthyl group are shown, respectively. Here A substituent The alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, the aryloxy group of carbon numbers 6-18, the acyl group of carbon numbers 1-6, the acyloxy machine of carbon numbers 1-6, a carboxyl group, a styryl machine, They are the aryl carbonyl group of carbon numbers 6-20, the aryloxy carbonyl group of carbon numbers 6-20, the alkoxy carbonyl group of carbon numbers 1-6, a vinyl group, the Ernie Reno carbonyl group, a carbamoyl group, a phenyl group, a nitro group, a hydroxyl group, or a halogen atom. More than one may be replaced. Therefore, for example, a substituent content aralkyl machine An alkyl group substitution aralkyl machine (a methyl benzyl, methyl phenethyl machine, etc.), An alkoxy-group substitution aralkyl machine (a methoxybenzyl machine, ethoxy phenethyl machine, etc.), An aryloxy group substitution aralkyl machine (a phenoxy benzyl, naphthyloxy phenethyl machine, etc.), Phenyl group substitution aralkyl machines (phenyl phenethyl machine etc.) and the above-mentioned substituent content phenyl group An alkyl group substitution phenyl group (a tolyl group, a dimethylphenyl machine, ethyl phenyl group, etc.), They are alkoxy-group substitution phenyl group (methoxypheny machine, ethoxy phenyl group, etc.) aryloxy group substitution phenyl groups (a phenoxyphenyl machine, naphthyloxy phenyl group, etc.) or a phenyl group substitution phenyl group (getting it blocked biphenylyl machine). Moreover, substituent content cyclohexyl machines are alkyl group substitution cyclohexyl machines (a methyl cyclohexyl machine, a dimethyl cyclohexyl machine, ethyl cyclohexyl machine, etc.), alkoxy-group substitution cyclohexyl machines (a methoxy cyclohexyl machine, ethoxy cyclohexyl machine, etc.) or an aryloxy group substitution cyclohexyl machine (a phenoxy cyclohexyl machine, naphthyloxy cyclohexyl machine), and a phenyl group substitution cyclohexyl machine (phenyl cyclohexyl machine). Substituent content naphthyl groups are alkyl group substitution naphthyl groups (a methyl naphthyl group, dimethyl naphthyl group, etc.), alkoxy-group substitution naphthyl groups (a methoxy naphthyl group, ethoxy naphthyl group, etc.) or an aryloxy group substitution naphthyl group (a phenoxy naphthyl group, naphthyloxy naphthyl group), and a phenyl group substitution naphthyl group (phenyl naphthyl group).

[0013] above-mentioned R1 -R4 ****** -- the alkyl group of carbon numbers 1-6, an aryloxy group, a phenyl group, a naphthyl group, a biphenyl machine, and a cyclohexyl machine are desirable respectively among what was mentioned above Any which are not replaced [substitution or] are sufficient as these. Moreover, R1 -R4 Even if the same, it may differ mutually, and it is R1. R2 And R3 R4 It may combine with the basis replaced mutually and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation substitution, or] or an unsaturation may be formed.

[0014] On the other hand, Ar in a general formula (I) expresses the arylene machine of the carbon numbers 6-20 which are not replaced [substitution or], are arylene machines, such as the phenylene group which is not replaced [substitution or], a biphenylene machine, p-Tell phenylene group, a naphthylene machine, a terphenylene machine, a naphthalene diyl machine, an anthracene diyl machine, a phenanthrene diyl machine, and a phenalene diyl

machine, and may be replaced also in no replacing. Moreover, the joint position of methylidyne (=C=CH-) of ORUTO, meta, and Para etc. is good anywhere. However, it is R1 -R4 when Ar is a non-replaced phenylene. It is chosen out of the naphthyl group which is not replaced [the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or], a biphenyl machine, a cyclohexyl machine, and an aryloxy group. A substituent An alkyl group (a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, iso hexyl machine, etc.), An alkoxy group (a methoxy machine, an ethoxy basis, a propoxy group, an isopropoxy group, a butyloxy machine, an isobutyloxy machine, a sec-butyloxy machine, t-butyloxy machine, an isopentyloxy machine, t-pentyloxy machine), Aryloxy groups (a phenoxy machine, naphthyloxy machine, etc.), an acyl group (a formyl machine, an acetyl group, a propionyl machine, butyryl machine, etc.), An acyloxy machine, an aralkyl machine (a benzyl, phenethyl machine, etc.), It is a phenyl group, a hydroxyl group, a carboxyl group, the Ernie Reno carbonyl group, a carbamoyl group, an aryloxy carbonyl group, a methoxycarbonyl group, an ethoxycarbonyl machine, a butoxycarbonyl machine, a nitro group, and a halogen atom, and more than one may be replaced also in single substitution.

[0015] The methylidyne aromatic compound expressed with the aforementioned general formula (I) has two methylidyne (=C=CH-) machines, and the combination of a combination [four kinds of], i.e., SHISU-SHISU, transformer-SHISU, and SHISU-transformer and a transformer-transformer is in 1 molecule with the geometrical isomerism of this methylidyne machine. The first luminous layer in the EL element of this invention may be which those things, and what the geometrical isomer mixed is sufficient as it. It is the thing of a transformer object altogether especially preferably. Moreover, it may join together between substituents and the above-mentioned substituent may form the five membered ring or six membered ring of the saturation which is not replaced [substitution and] or an unsaturation.

[0016] A and B in a general formula (II) show the monad excluding one hydrogen atom from the compound expressed with the above-mentioned general formula (I), respectively, and even if the same, they may differ. Here, Q in a general formula (II) shows the bivalent machine with which conjugated system is cut. Here, conjugate contains what depends on the un-existing-locally nature of a pi electron, and is depended on conjugated double bond, an unpaired electron, or a lone-pair electrons. As an example of Q, it is [0017].

[Formula 8]

$-CH_2-$, $-CH_2CH_2-$,

$-CH(CH_3)-CH_2-$, $CH_3-C(CH_3)-CH_3$,

$-CH_2CH_2CH_2-$,

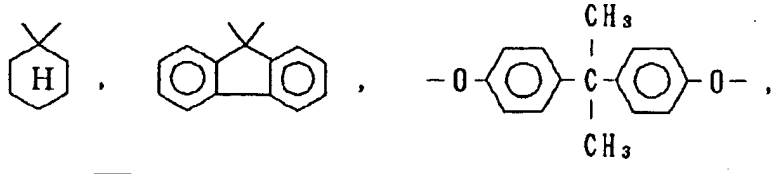
$-O-$, $-O-CO-O-$,

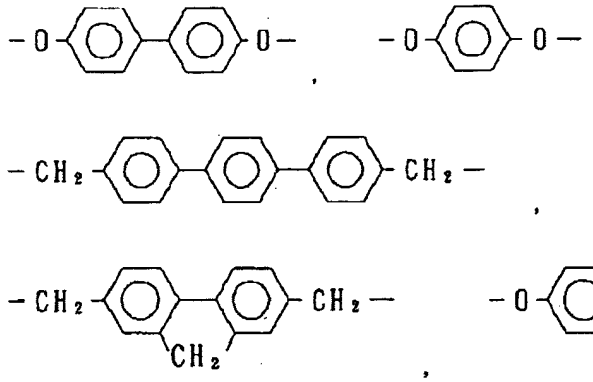
$-OCH_2CH_2O-$,

$-CO-CO-$,

$-COCH_2CO-$,

$-CO(CH_2)_2CO-$,

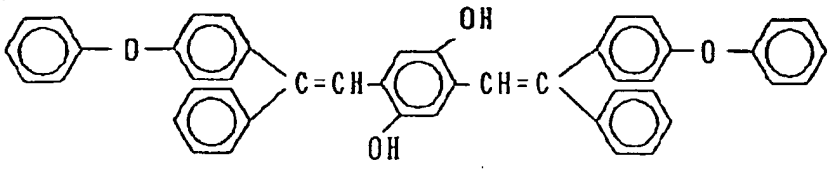


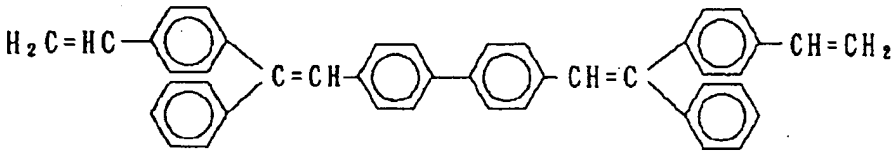


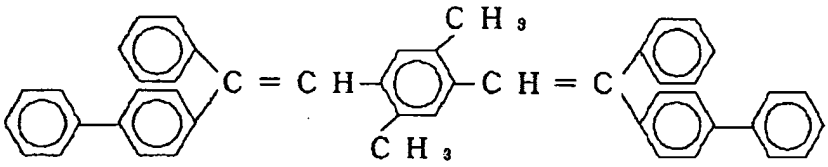
[0018] **********. Thus, the reason using the bivalent basis which cuts conjugated system is for making it EL luminescent color obtained when A or B (namely, compound of a general formula (I)) shown above is independently used as an organic EL element of this invention, and EL luminescent color obtained when the compound expressed with a general formula (II) is used as an organic EL element of this invention not change. That is, it is for making it short wavelength-ization or not form [of the first luminous layer expressed with a general formula (I) or a general formula (II)] long wavelength. Moreover, if it connects with the bivalent machine with which conjugated system is cut, it can check going up, a uniform pinhole free-lancer's microcrystal or amorphous nature thin film can be obtained, and the glass transition temperature (Tg) will raise luminescence homogeneity. Furthermore, composition or refining is equipped with the advantage made easily, without EL luminescence forming long wavelength by having joined together with the bivalent machine with which conjugated system is cut.

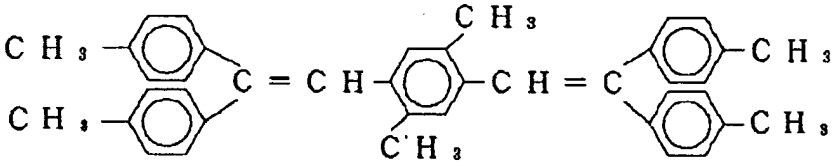
[0019] Moreover, A1 in a general formula (III) The arylene machine of the carbon numbers 6-20 which are not replaced [substitution or] or a bivalent aromatic heterocycle formula machine, and A2 The aryl groups (the phenyl group, the biphenyl machine, naphthyl group, etc.) or the monovalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or] is shown. R5 And R6 They are the aryl group of the carbon numbers 6-20 which are not replaced [a hydrogen atom, substitution, or], a cyclohexyl machine, a monovalent aromatic heterocycle formula machine, and the alkyl group () of carbon numbers 1-10, respectively. [a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl an isobutyl machine,] [sec] - Butyl, Tert-Butyl, Isopentyl Machine, T-Pentyl Machine, Neopentyl Machine, Iso Hexyl Machine, Etc., The aralkyl machines (a benzyl, phenethyl machine, etc.) of carbon numbers 7-20 or the alkoxy groups (a methoxy machine, an ethoxy basis, a propoxy group, butoxy machine, etc.) of carbon numbers 1-10 are shown. In addition, R5 and R6 You may differ, even if the same. Here, a substituent may be a phenyl group which it does not have or it has an alkyl group, an aryloxy group, amino groups, or these bases, and even if this substituent is single, plural is sufficient as it. R5 Each substituent is A1. It may join together, the five membered ring or six membered ring of saturation or an unsaturation may be formed, and it is R6 similarly. Each substituent is A2. It may join together and the five membered ring or six membered ring of saturation or an unsaturation may be formed. Moreover, Q expresses the bivalent machine with which conjugate is cut like the above. furthermore -- this -- A1 Any of ORUTO, meta, and Para are sufficient as combination. Furthermore, in this invention, the organic compound expressed with a general formula (I), an above-mentioned general formula (II), or an above-mentioned general formula (III) needs to be the compound which presents luminescence of the purple-blue in a CIE chromaticity coordinate, ****, blue, copper rust, or bluish green. Specifically, it is [0020].

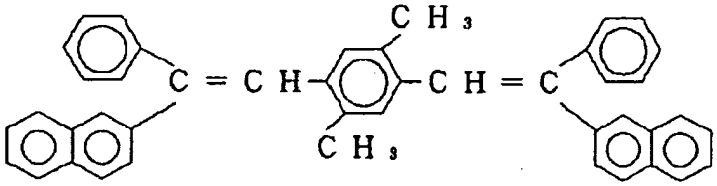
[Formula 9]

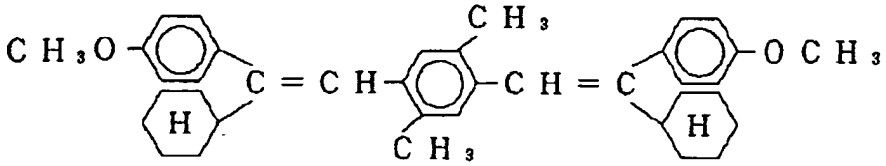




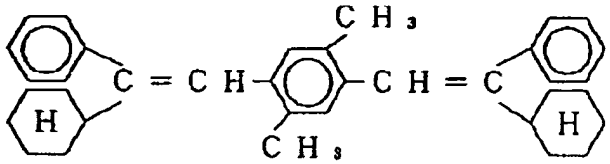


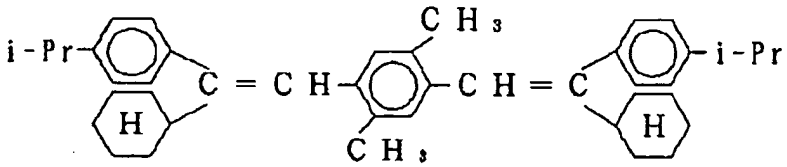




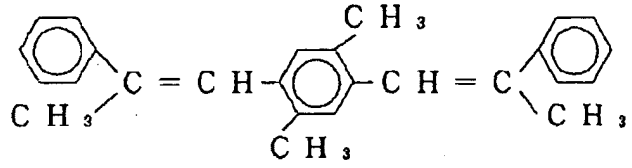


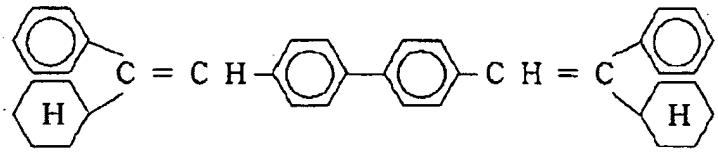
[0021]
[Formula 10]

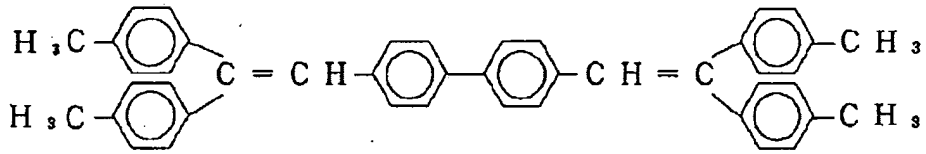


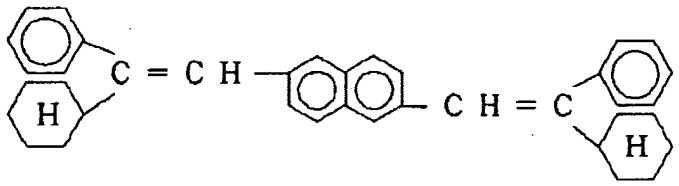


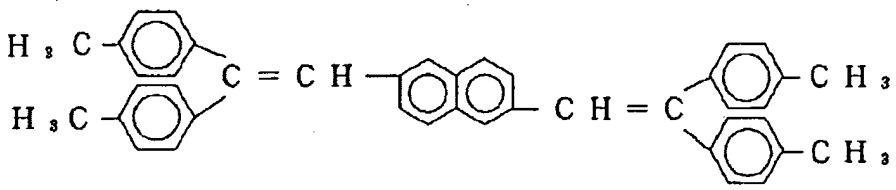
i-Pr ：イソプロピル基，以下同様



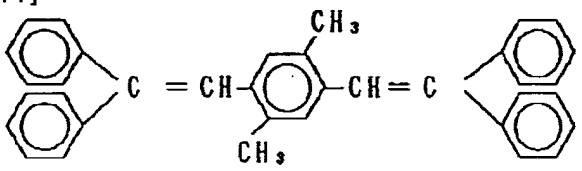


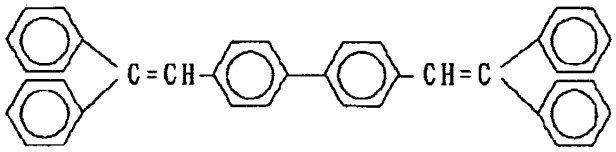


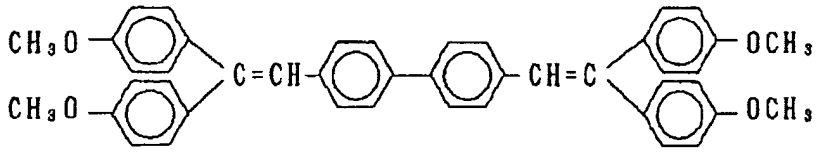


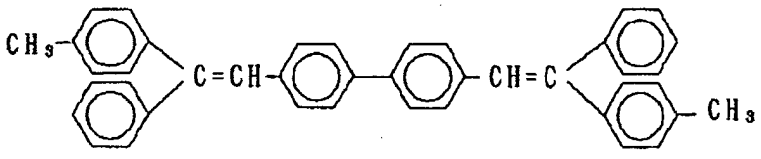


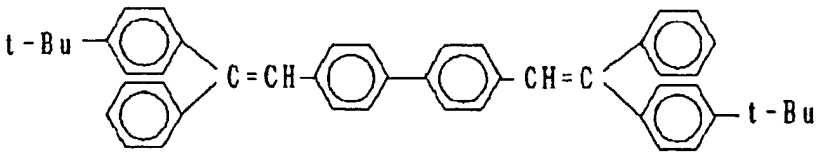
[0022]
[Formula 11]



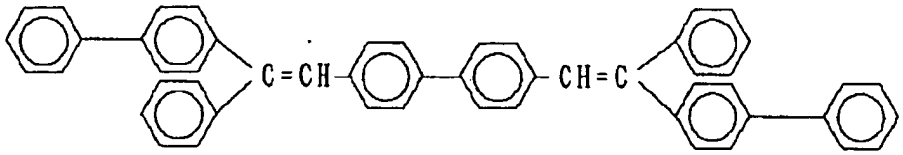




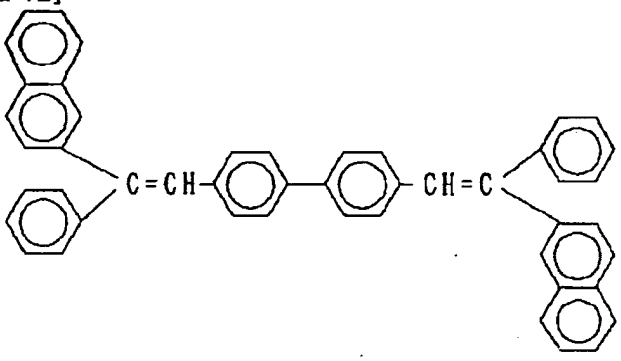


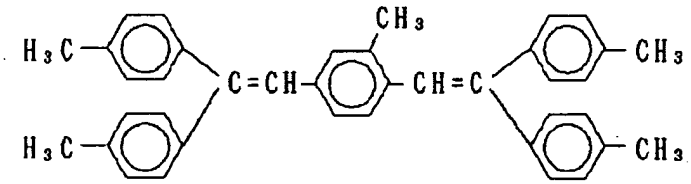


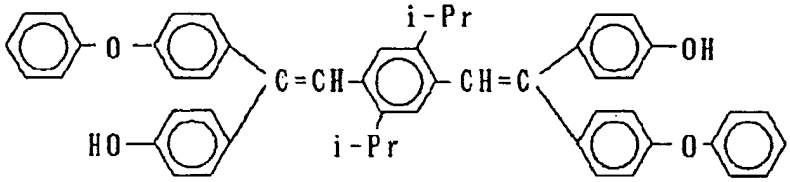
t-Bu：ｔ－ブチル基，以下同様

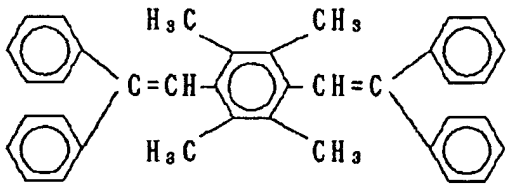


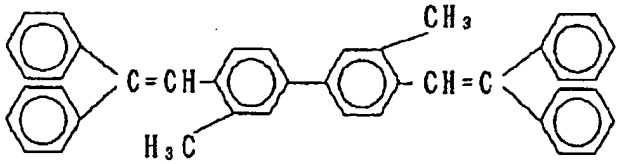
[0023]
[Formula 12]



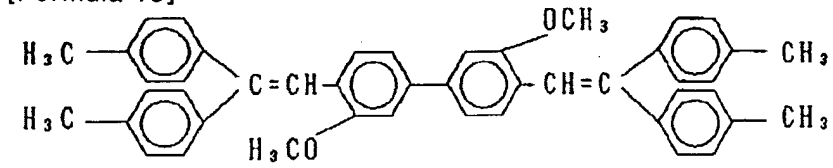


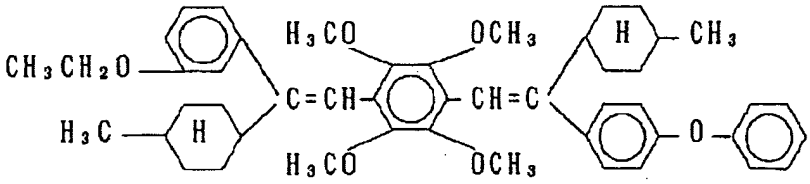


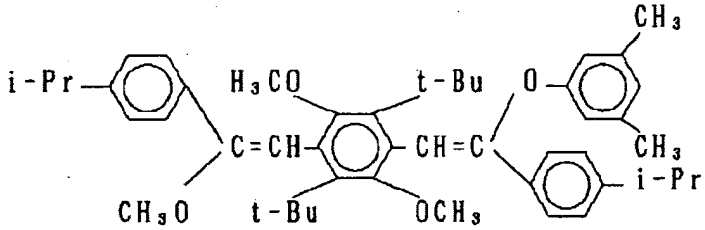


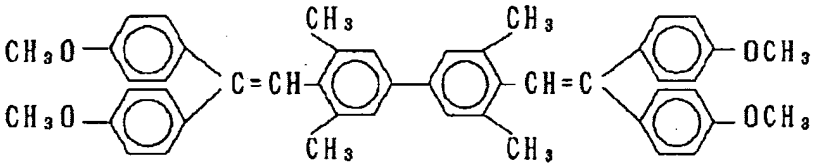


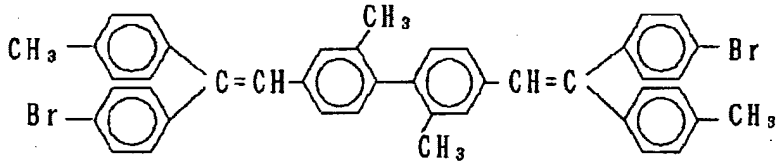
[0024]
[Formula 13]



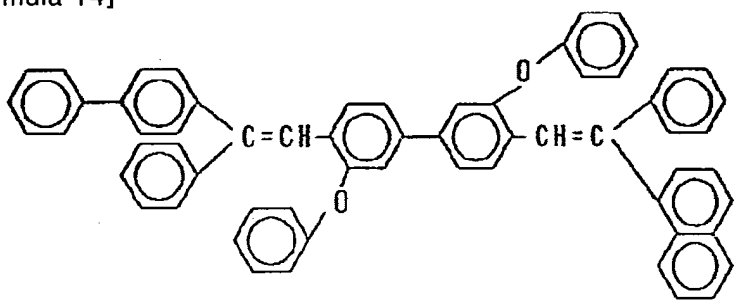


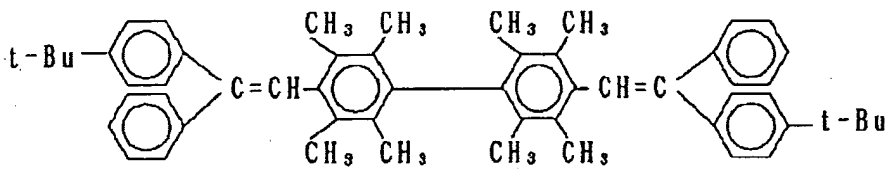


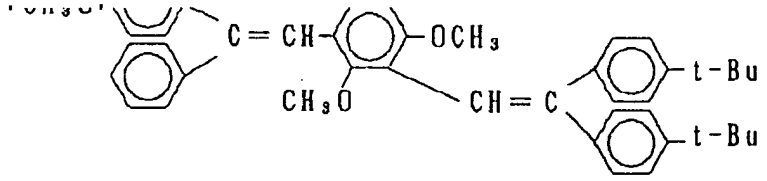


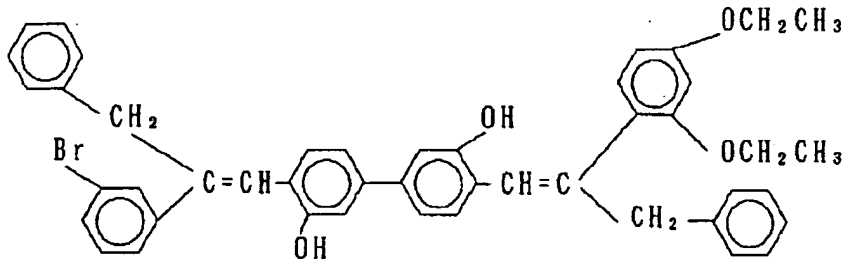


[0025]
[Formula 14]

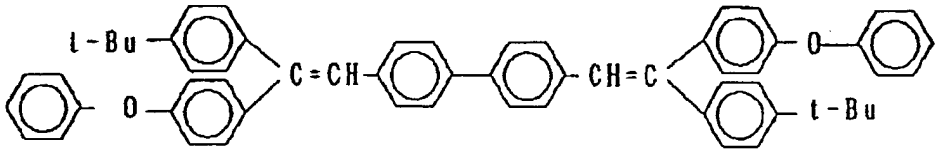


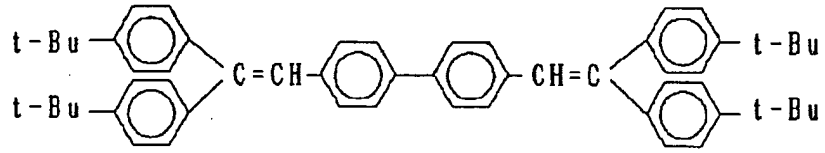


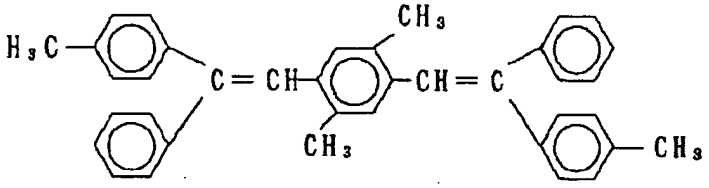


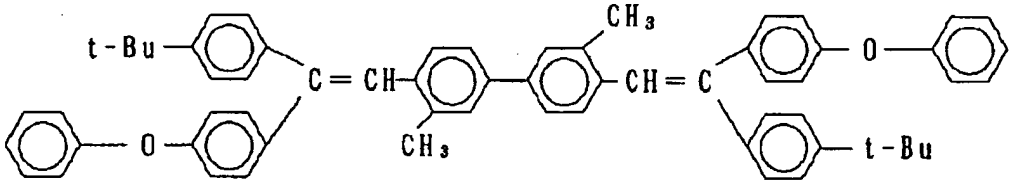


[0026]
[Formula 15]

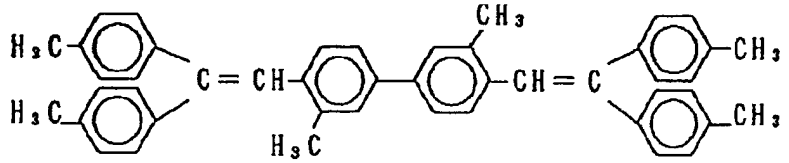


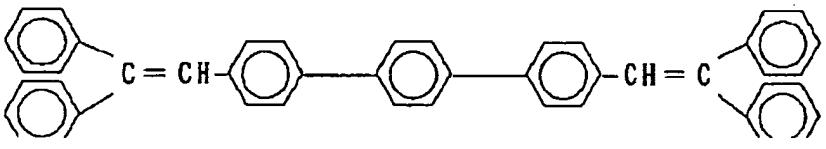


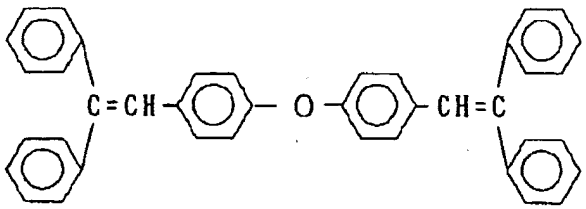


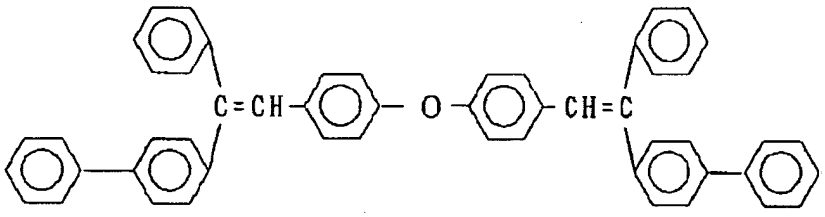


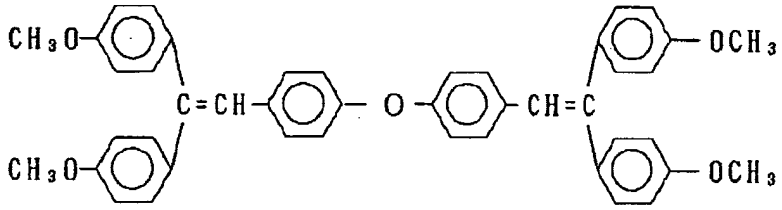
[0027]
[Formula 16]



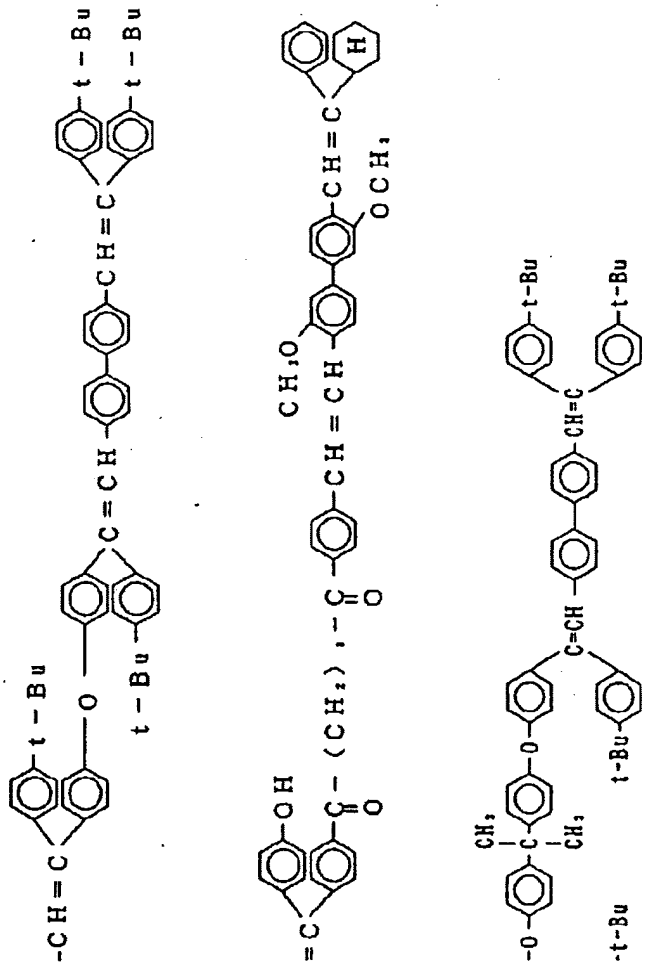




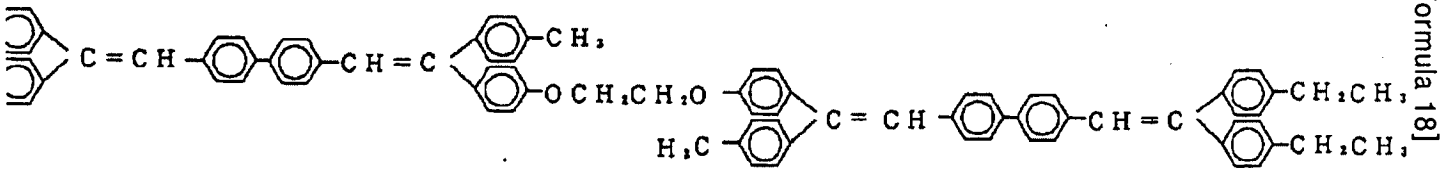


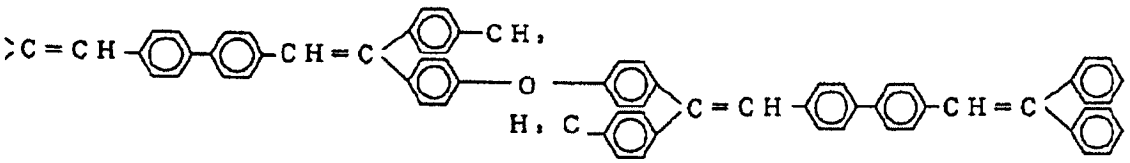


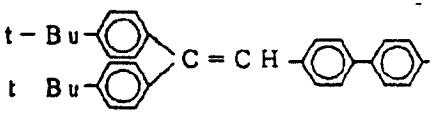
[0028]
[Formula 17]

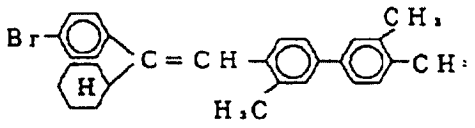


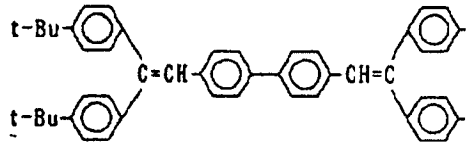
[0029]
[Formula 18]

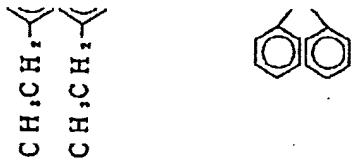




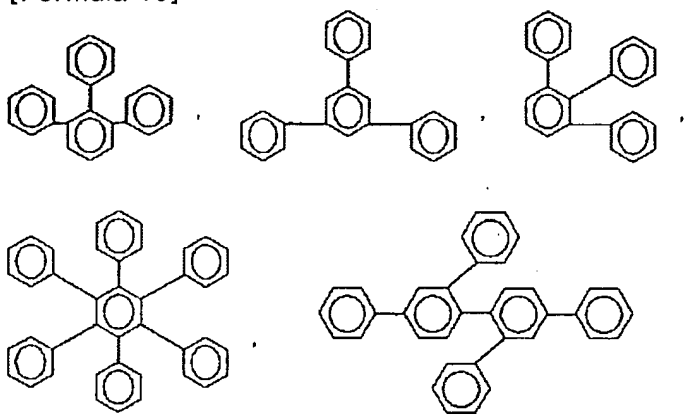




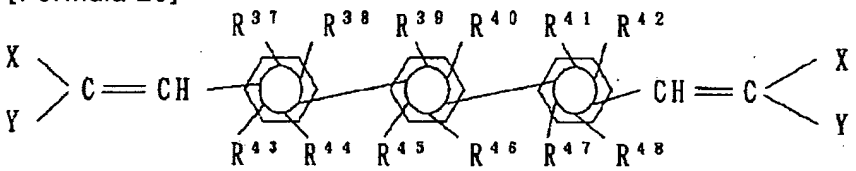




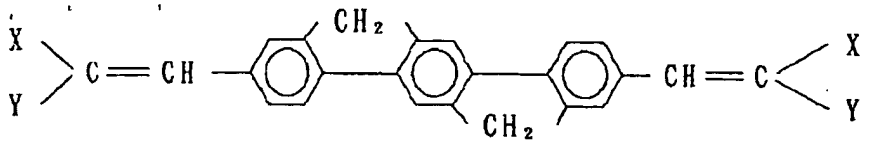
[0030] It is ****. As other organic compounds, it is [0031].
[Formula 19]



[0032] **** is also mentioned. Moreover, as a compound which fulfills the fluorescence conditions of the first luminous layer of the above indicated by the Japanese-Patent-Application-No. No. 170354 [five to] specification, it is general formula (XI) [0033].
[Formula 20]

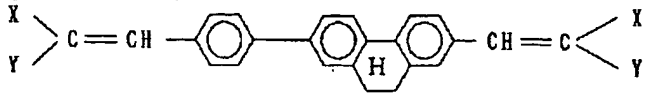


[0034] R37-R48 show a hydrogen atom or the alkyl group of carbon numbers 1-6 independently among [formula, respectively. However, at least one of R37-R48 is the alkyl group of carbon numbers 1-6. Moreover, it may join together mutually and R38, R39 and R40, R41 and R44, and R45, R46 and R47 may form the five membered ring or six membered ring of saturation or an unsaturation. X and Y show independently the aryl group of the carbon numbers 6-20 which are not replaced [substitution or], respectively. X and Y may combine with a substituent and may form the five membered ring or six membered ring of the saturation which is not replaced [substitution or] or an unsaturation. Here, as a substituent, the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aryloxy group of carbon numbers 6-18, a phenyl group, the amino group, a cyano group, a nitro group, a hydroxyl group, or a halogen atom is shown. Two or more these substituents may be replaced even if single.] It can come out and the styryl compound of the terphenylene derivative expressed can be mentioned.
[0035] Here, in a general formula (XI), R37-R48 show the alkyl group of the carbon numbers 1-6, such as a hydrogen atom or a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, n-hexyl machine, and an iso hexyl machine, independently, respectively. However, at least one of R37-R48 is the alkyl group of carbon numbers 1-6, and especially its methyl group or ethyl group is desirable. Moreover, it may join together mutually and R38, R39 and R40, R41 and R44, and R45, R46 and R47 may form the six membered ring of the five membered ring of saturation or an unsaturation, saturation, or an unsaturation. As an example of the styryl compound which has the five membered ring or six membered ring of saturation or an unsaturation, when R38, R39, and R46 and R47 form a saturation five membered ring, it is [0036].
[Formula 21]



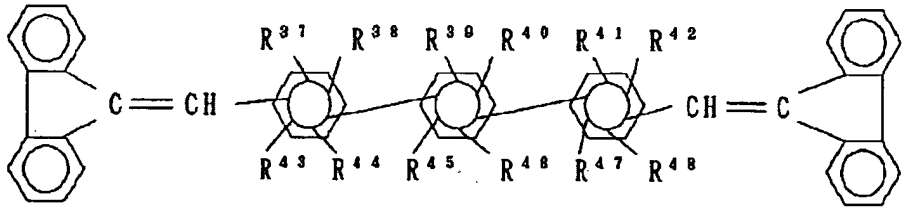
[0037] It is [0038], when **** is mentioned and it forms a saturation six membered ring by R46 and R47.

[Formula 22]



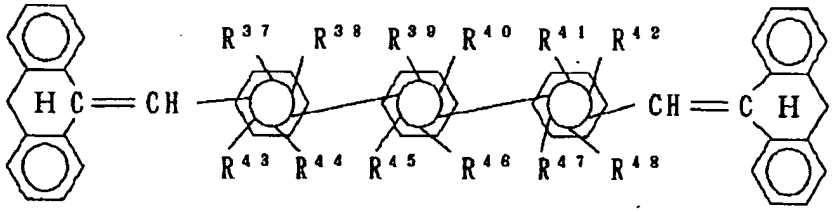
[0039] **** is mentioned. X and Y show independently aryl groups of carbon numbers 6-20, such as the phenyl group which is not replaced [substitution or], a naphthyl group, a biphenyl machine, a terphenyl machine, an ANTORARIRU machine, a phenan tolyl group, a pyrenyl machine, and a peri RENIRU machine, respectively. Here as a substituent For example, the alkyl group of the carbon numbers 1-6, such as a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, n-hexyl machine, and an iso hexyl machine The alkoxy group of the carbon numbers 1-6, such as a methoxy machine, an ethoxy basis, n-propoxy group, an isopropoxy group, n-butyloxy machine, an isobutyloxy machine, a sec-butyloxy machine, an isopentyloxy machine, a t-pentyloxy machine, and an n-hexyloxy machine The aryloxy group of carbon numbers 6-18, a phenyl group, the amino group, a cyano group, a nitro group and hydroxyl groups, such as a phenoxy machine and a naphthyloxy machine, or a halogen atom is mentioned. Two or more these substituents may be replaced even if single. Moreover, X and Y may combine with a substituent and may form the six membered ring of the five membered ring of the saturation which is not replaced [substitution or] or an unsaturation, saturation, or an unsaturation. As an example of the styryl compound which has the five membered ring or six membered ring of saturation or an unsaturation, when X and Y form a saturation five membered ring, it is [0040].

[Formula 23]



[0041] It is [0042], when **** is mentioned and X and Y carry out saturation six membered ring formation.

[Formula 24]



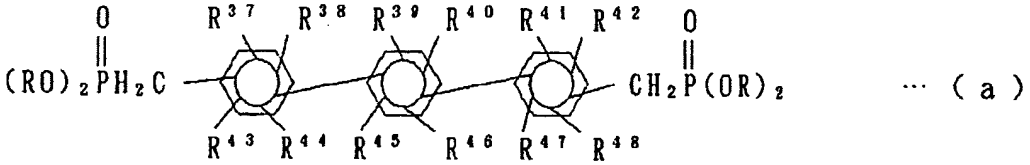
[0043] **** is mentioned.

[0044] The styryl compound expressed with the above-mentioned general formula (XI) can be manufactured by various well-known methods. Specifically, the following two methods are mentioned.

Method 1 general formula (a)

[0045]

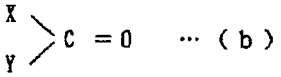
[Formula 25]



[0046] R shows the alkyl group or phenyl group of carbon numbers 1-4 among [formula, and R37-R48 are the same as the above.] The phosphonate come out of and expressed, and a general formula (b)

[0047]

[Formula 26]

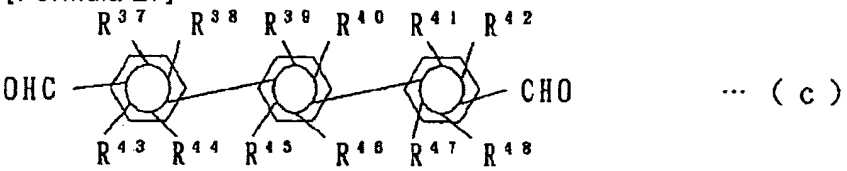


[0048] X and Y are the same as the above among [formula.] It is compoundable by the method (a Wittig reaction or Wittig-Horner reaction) of coming out and condensing the carbonyl compound expressed under base existence.

Method 2 general formula (c)

[0049]

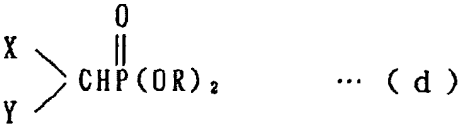
[Formula 27]



[0050] R37-R48 are the same as the above among [formula.] The dialdehyde compound and general formula (d) which are come out of and expressed

[0051]

[Formula 28]



[0052] R, X, and Y are the same as the above among [formula.] It is compoundable by the method (a Wittig reaction or Wittig-Horner reaction) of coming out and condensing the phosphonate expressed under base existence.

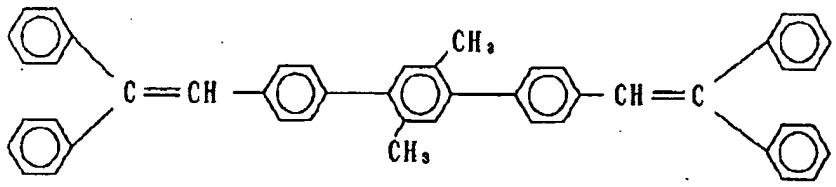
[0053] As a reaction solvent used by this composition, a hydrocarbon, alcohols, and ether are desirable. Specifically, methanol; ethanol; isopropanol; butanol; 2-methoxyethanol;1, 2-dimethoxyethane; screw (2-methoxy ethyl) ether; dioxane; tetrahydrofuran; toluene; xylene; dimethyl sulfoxide; N.N-dimethylformamide;N-methyl pyrrolidone;1, and 3-dimethyl-2-imidazolidinone etc. is mentioned. Especially, a tetrahydrofuran and dimethyl sulfoxide are suitable. Moreover, as a condensing agent, a sodium hydroxide, a potassium hydroxide, a sodium amide, a sodium hydride, n-butyl lithium, a sodium methylate, potassium-t-butoxide, etc. are desirable, and n-butyl lithium and potassium-t-butoxide are especially desirable. Although reaction temperature changes with kinds of reaction raw material to be used etc. and cannot be defined uniquely, it can usually specify the large area to 0 degree C - about 100 degrees C. It is the range of 0 degree C - a room temperature especially preferably.

[0054] Although example [of the above-mentioned styryl compound used for below by this invention] (1) - (26) is mentioned, this invention is not limited to them.

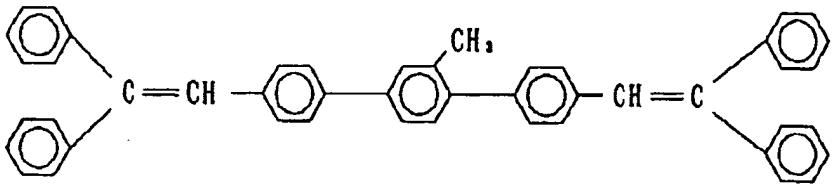
[0055]

[Formula 29]

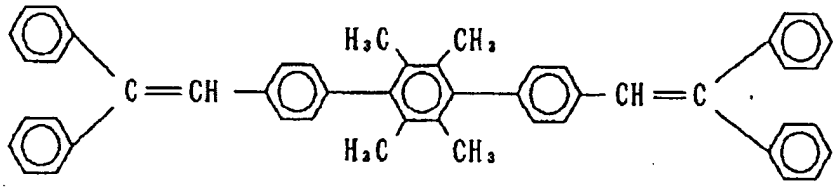
(1)



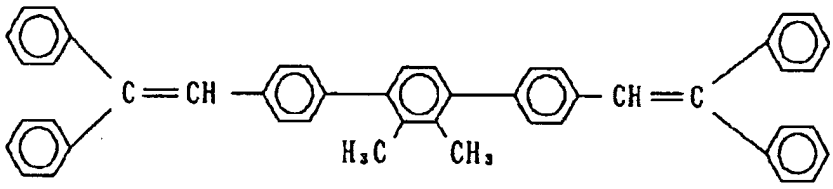
(2)



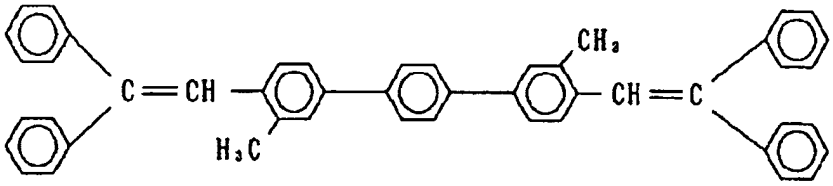
(3)



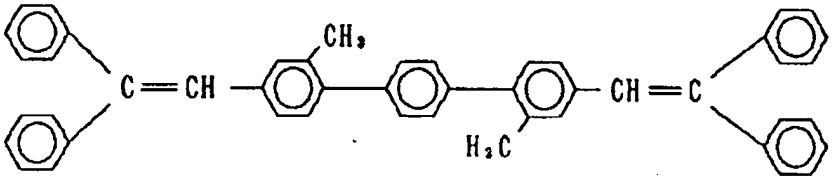
(4)



(5)



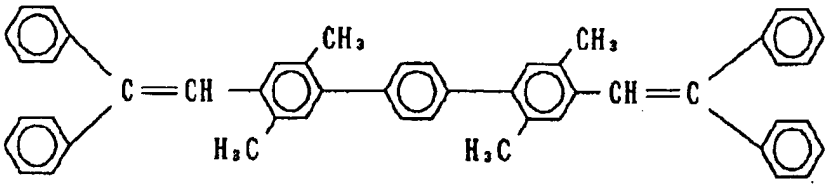
(6)



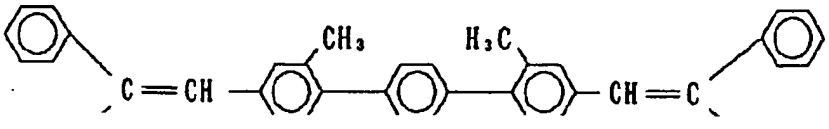
[0056]

[Formula 30]

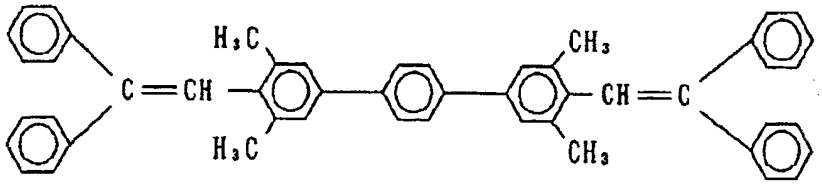
(7)



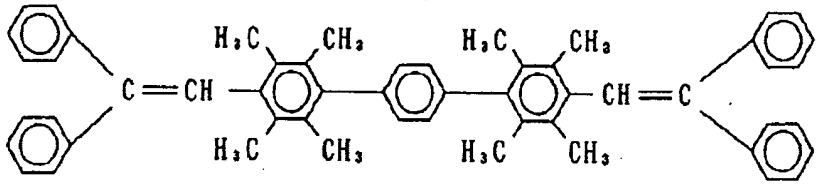
(8)



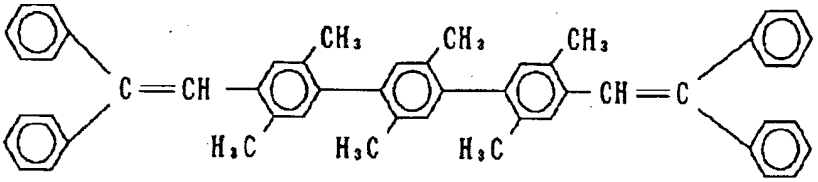
(9)



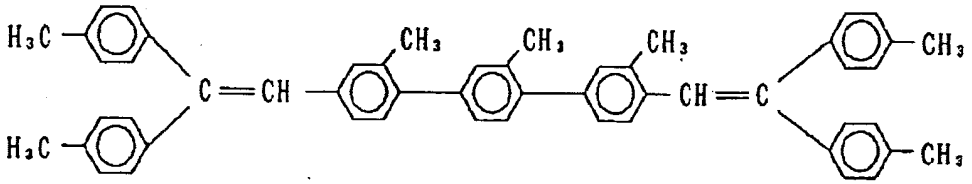
(10)



(11)



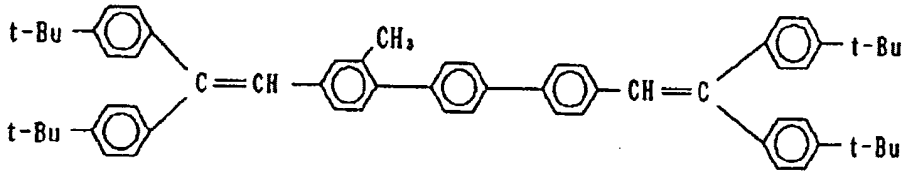
(12)



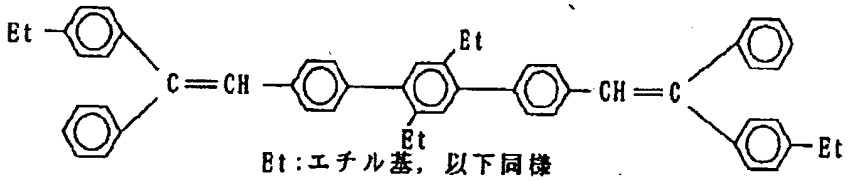
[0057]

[Formula 31]

(13)

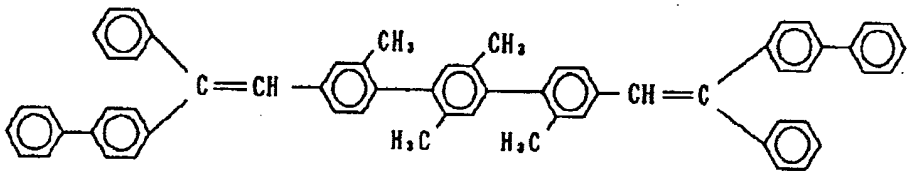


(14)

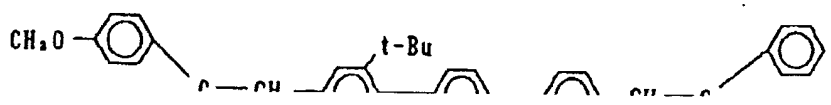


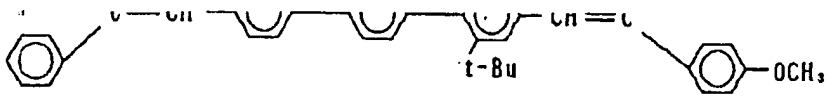
Et：エチル基，以下同様

(15)

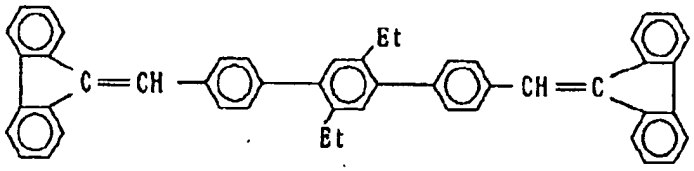


(16)

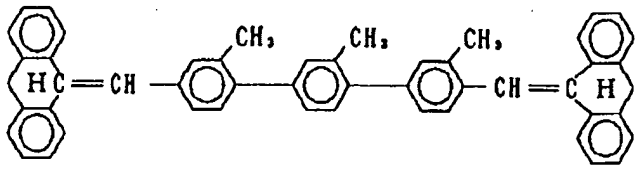




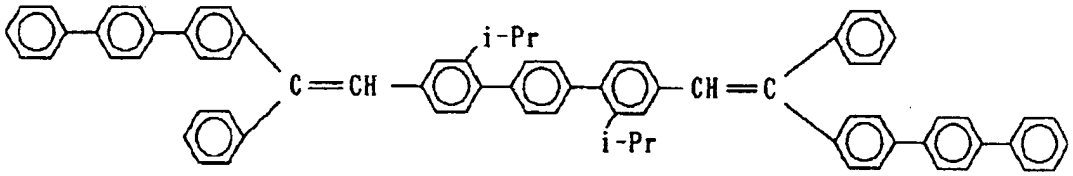
(1 7)



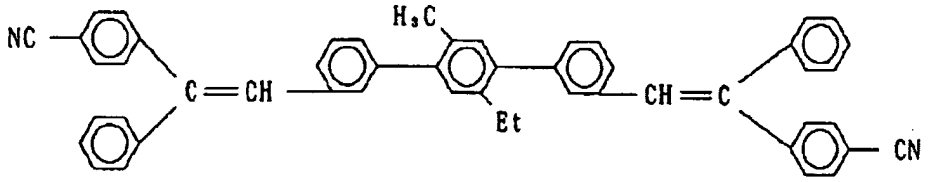
(1 8)



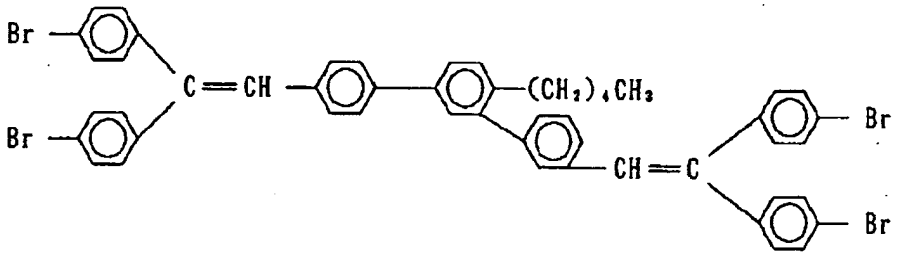
[0058]
[Formula 32]
(1 9)



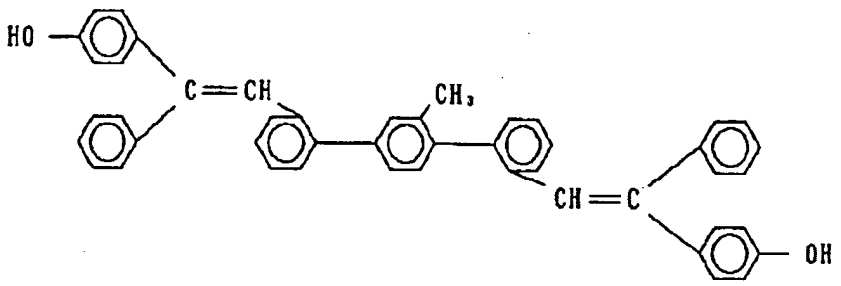
(2 0)



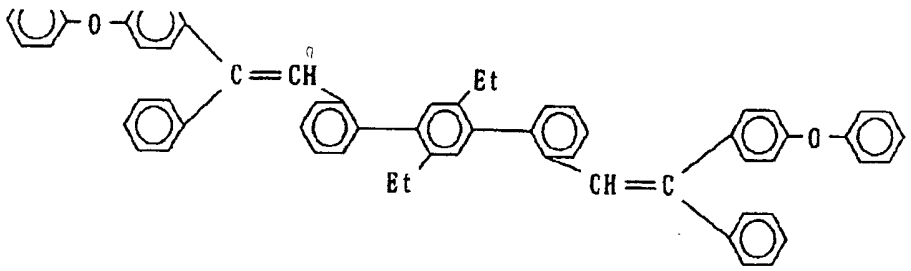
(2 1)



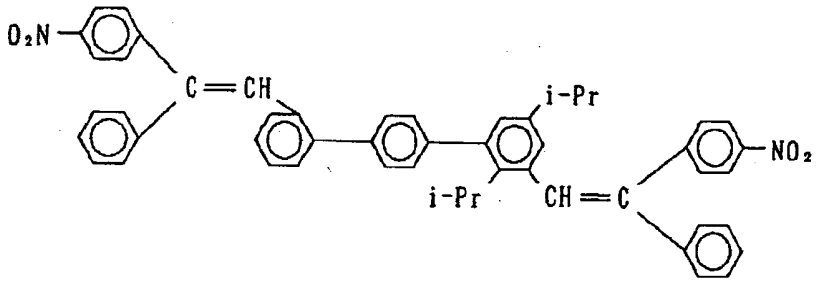
(2 2)



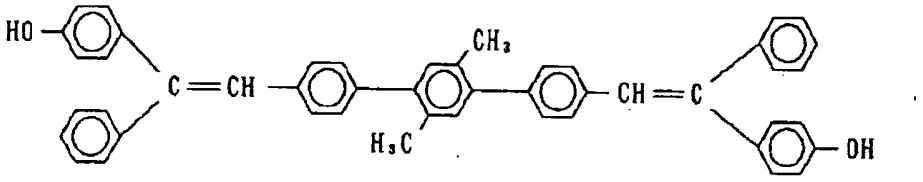
[0059]
[Formula 33]
(2 3)



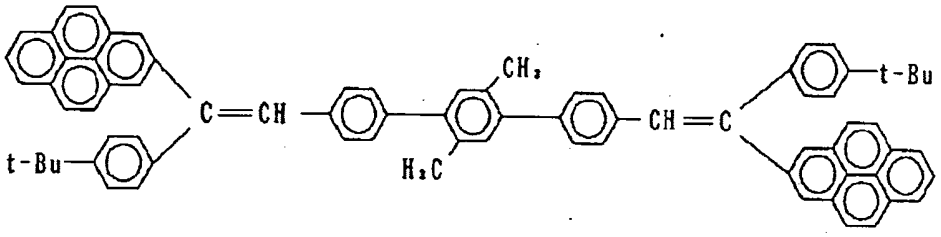
(24)



(25)

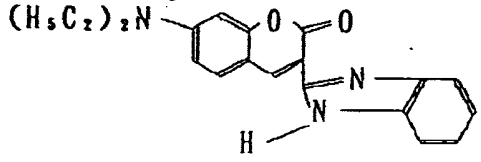


(26)

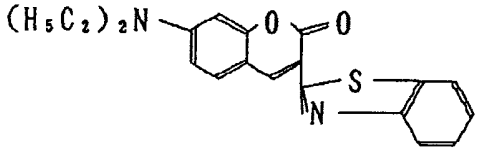


[0060] On the other hand, about the organic compound which is used for the second luminous layer and whose fluorescence peak wavelength of a solid state is 480nm or more less than 580nm, the coumarin derivative used as laser coloring matter which especially a limit does not have, for example, is indicated by the Europe public presentation patent No. 0281381 official report is mentioned. Specifically, it is [0061].

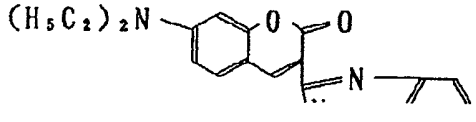
[Formula 34]



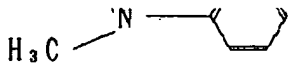
・・・クマリン7

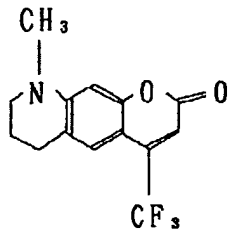


・・・クマリン6

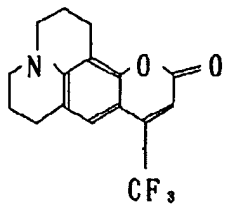


・・・クマリン30





・・・クマリン522

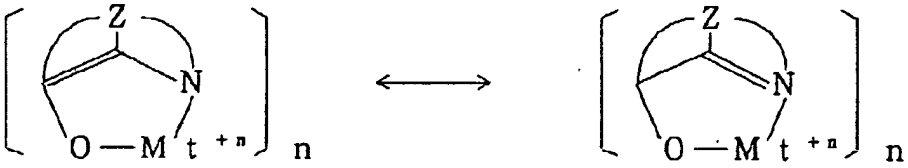


・・・クマリン153

[0062] It is ****. Furthermore, what satisfies the fluorescence conditions of the second luminous layer of the above in the organic compound indicated by JP,3-231970,A or the Japanese-Patent-Application-No. No. 279304 [two to] specification is mentioned. Furthermore, the metal complex of 8-hydroxyquinoline or its derivative can be mentioned as a desirable thing. Specifically, it is a metal chelate oxy-NOIDO compound containing the chelate of an oxine (generally an eight quinolinol or 8-hydroxyquinoline). Such a compound shows a high level performance and is easily fabricated by the thin film gestalt. The example of an oxy-NOIDO compound fills the following structure expression.

[0063]

[Formula 35]



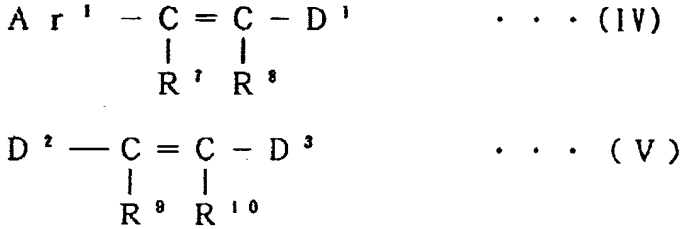
[0064] Mt expresses a metal among [formula, n is the integer of 1-3, and the atom which needs Z in order the position is independent in each and to complete at least two or more fused aromatic rings is shown.] Here, the metal expressed with Mt can be used as the monovalence and a bivalent or trivalent metal, and are earth metals, such as alkaline earth metal, such as alkali metal, such as a lithium, sodium, or a potassium, magnesium, or calcium, boron, or aluminum. Each the monovalence and the bivalent or trivalent metal which are known as it is generally a useful chelate compound can be used.

[0065] Moreover, Z shows the atom in which the heterocycle which one side of at least two or more fused aromatic rings becomes from an azole or an azine is made to form. Here, if required, it is possible to add the ring from which others differ to the above-mentioned fused aromatic ring. Moreover, in order to avoid adding a ******** molecule, with no improvement on a function, as for the number of the atoms shown by Z, maintaining or less to 18 is desirable.

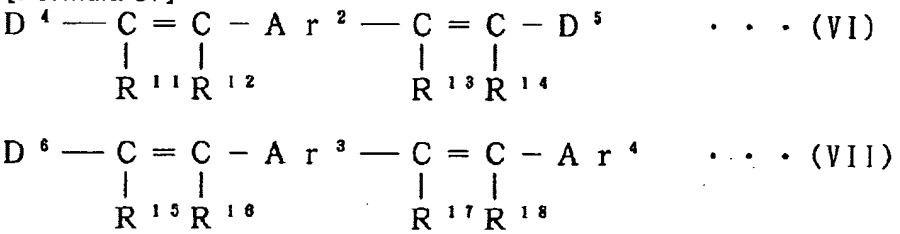
[0066] Furthermore, if a chelation oxy-NOIDO compound is illustrated concretely Tris Aluminum, a screw (Eight quinolinol) Magnesium, a screw (Eight quinolinol) Zinc, a screw (Eight quinolinol) Zinc, a screw (2-methyl-eight quinolinol) Zinc, a screw (Benzo-8-quinolinol) (2-methyl-8-quinolilato)aluminumoxide, a tris (eight quinolinol) indium, tris (5-methyl-eight quinolinol) aluminum, an eight-quinolinol lithium, a tris (5-chloro-eight quinolinol) gallium, tris A gallium, a screw (2-methyl-eight quinolinol) Calcium, 5, 7-dichloro-eight-quinolinol aluminum, tris (5, 7-dibromo-8-hydroxy quinolinol) aluminum, tris (7-propyl-eight quinolinol) aluminum, a screw (5-chloro-eight quinolinol) (Eight quinolinol) There are beryllium, screw (2-methyl-eight quinolinol) beryllium, etc.

[0067] In the white organic EL element of this invention, it is desirable to make [as which it was chosen from the stilbene derivative indicated by the first luminous layer of the above and/or the second luminous layer at the Japanese-Patent-Application-No. No. 129438 / five to / specification, the JISUCHIRIRU arylene derivative, and the tris styryl arylene derivative] a kind contain at least. This stilbene derivative is a compound which has at least two aromatic rings, combines these aromatic rings by the vinyl group or the replaced vinyl group, and is constituted, and has an electron repelling group in either the above-mentioned aromatic ring

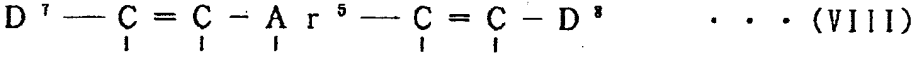
or a vinyl group. A JISUCHIRIRU arylene derivative is a compound which two aromatic rings combine with one arylene machine through a vinyl group or a substitution vinyl group, and has an electron repelling group. A tris styryl arylene derivative is a compound which three aromatic rings combine with one trivalent aromatic ring machine through a vinyl group or a substitution vinyl group, and has an electron repelling group. In the aforementioned derivative which has an electron repelling group in a molecule skeleton, this electron repelling group shows the amino group which has the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, and the hydrocarbon group of carbon numbers 1-30 preferably. In the above-mentioned derivative, especially a desirable thing is a compound expressed with following general formula (IV) - (X), (IV) and (V) express a stilbene derivative, (VI), and (VII) a JISUCHIRIRU arylene derivative, and - (VIII) (X) expresses a tris styryl arylene derivative.
[0068]
[Formula 36]

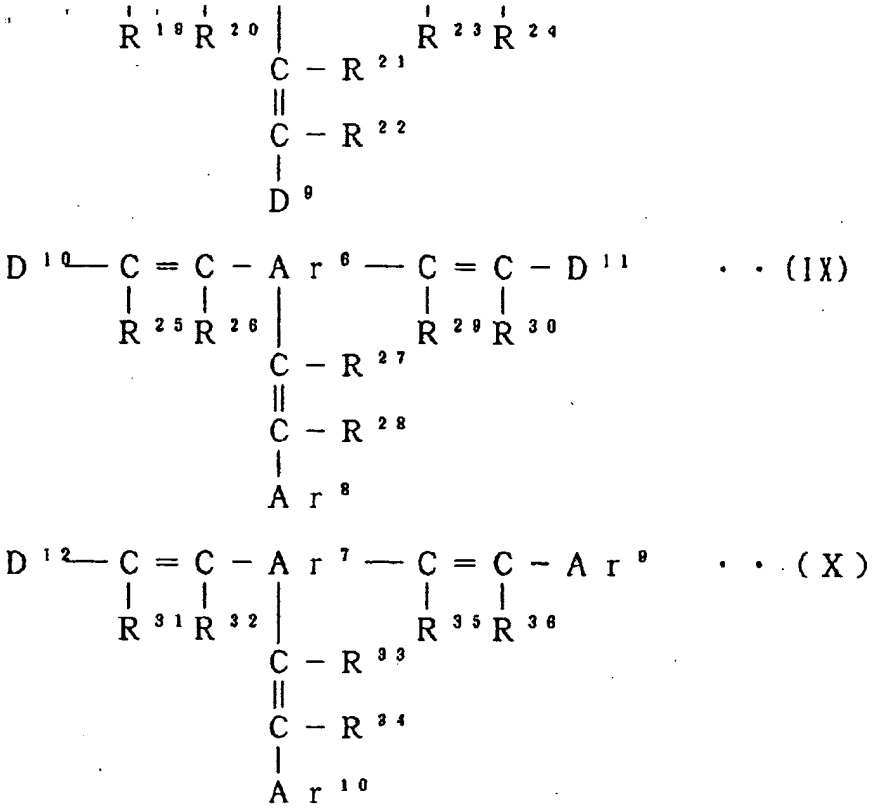


[0069] Ar1 shows the aryl group of carbon numbers 6-20 among [formula. R7 -R10 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D1 -D3 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown. Here, Ar1 and R7 -R10 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, this substituent may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation.]
[0070]
[Formula 37]



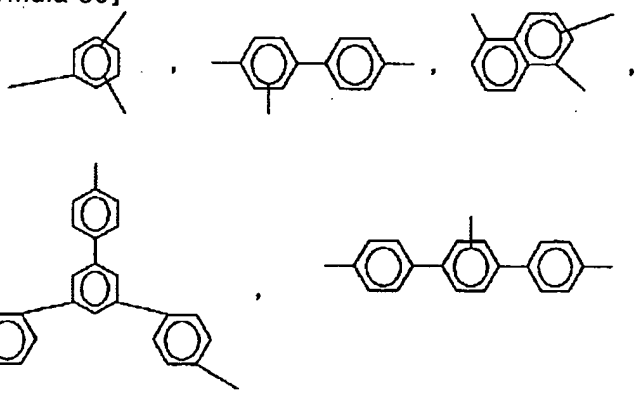
[0071] Among [formula, Ar2 and Ar3 show the arylene machine of carbon numbers 6-20 independently, respectively, and Ar4 shows the aryl group of carbon numbers 6-20. R11-R18 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. Here, Ar2 -Ar4, and R11-R18 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, these substituents may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation. D4 -D6 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown.]
[0072]
[Formula 38]





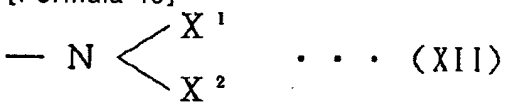
[0073] Among [formula, Ar5 -Ar7 shows the trivalent aromatic ring machine of carbon numbers 6-24 independently, respectively, and Ar8 -Ar10 shows the aryl group of carbon numbers 6-20 independently, respectively. R19-R36 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D7 -D12 show the aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively, or the condensation polycyclic group machine of carbon numbers 10-30. Here, Ar5 -Ar7, and R19-R36 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aralkyl machine of carbon numbers 6-10, the arylated-alkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, these substituents may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation.] The above-mentioned general formula (IV) As an aryl group in - (X), a phenyl group, a biphenylyl machine, a naphthyl group, a pyrenyl machine, a TAFENIRUIRU machine, an anthranil, a tolyl group, a xylyl group, a stilbenyl machine, a thienyl group, a BICHIENIRU machine, a thiophene machine, a bithiophene machine, a TACHIOFEN machine, etc. are mentioned preferably. As an arylene machine, a phenylene group, a biphenylene machine, a naphthylene machine, an anthra NIREN machine, a terphenylene machine, a pyrenylene machine, a still BENIREN machine, a thienylene machine, a BICHIENIREN machine, etc. are mentioned preferably. A trivalent aromatic ring machine is [0074] preferably.

[Formula 39]



[0075] **********. Moreover, as an aryloxy group which is the above-mentioned substituent, a phenyloxy machine, a biphenyl oxy-basis, a naphthyloxy machine, an anthranil oxy-basis, a terphenyl oxy-basis, a pyrenyl oxy-basis, etc. are mentioned, and a methyl group, an ethyl group, an isopropyl machine, a TASHARU butyl, a pentyl machine, a hexyl machine, etc. are mentioned as an alkyl group. As an alkoxy group, a methoxy machine, an ethoxy basis, an isopropoxy group, a TASHARU butoxy machine, a pentyloxy machine, etc. are mentioned, and a dimethylamino machine, a diethylamino machine, a diphenylamino machine, a phenyl ethylamino machine, a phenyl methylamino machine, a ditolylamino machine, an ethyl phenylamino machine, the phenyl naphthyl amino group, the phenyl biphenyl amino group, etc. are mentioned as an amino group which has a hydrocarbon group. The aforementioned general formula (IV) D1 -D12 in - (X) are the aryl group of the carbon numbers 1-20 replaced by the electron repelling group, or the condensation polycyclic group machine of carbon numbers 10-30. Here, with an electron repelling group, the amino group which has the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-20, and the hydrocarbon group of carbon numbers 1-30 preferably is mentioned, and the amino group which has the hydrocarbon group of carbon numbers 1-30 preferably especially is mentioned. As this amino group, it is a general formula (XII) [0076].

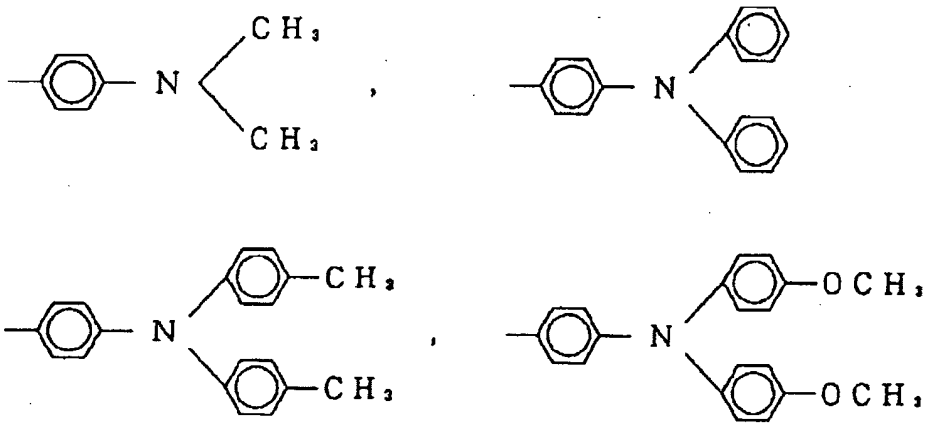
[Formula 40]

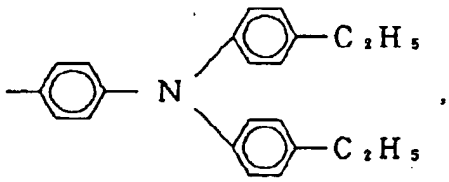
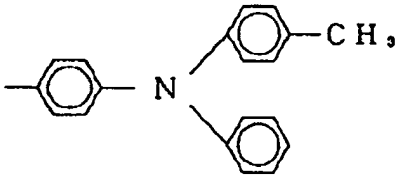
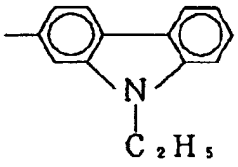
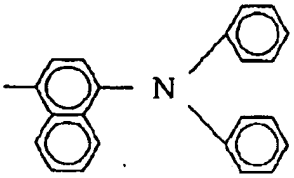
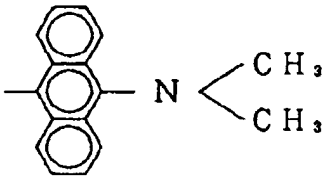


$$-N\begin{matrix}X^1\\X^2\end{matrix} \quad \cdots \quad (XII)$$

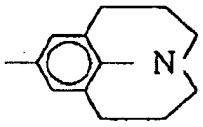
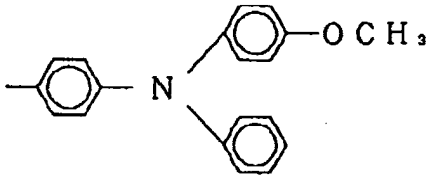
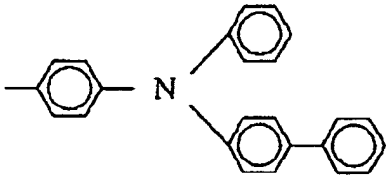
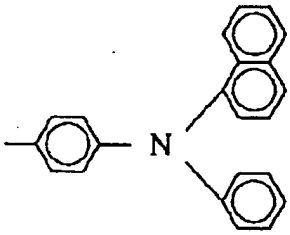
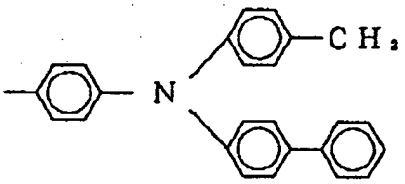
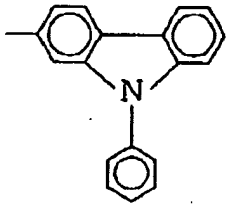
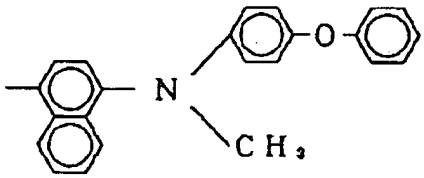
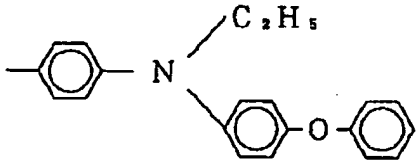
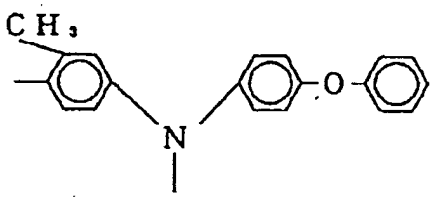
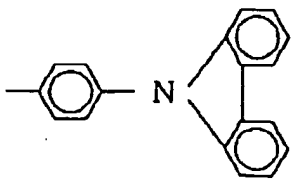
[0077] Among [formula, the aryl group of carbon numbers 6-20, the alkyl group of carbon numbers 1-10, or the aralkyl machine of carbon numbers 6-20 may be shown independently, respectively, it may join together mutually, and X1 and X2 may form the cyclic structure of saturation or an unsaturation. X1 and X2 **** -- the alkyl group of carbon numbers 1-10, the aralkyl machine of carbon numbers 7-10, the aryloxy group of carbon numbers 6-10, or the alkoxy group of carbon numbers 6-10 may replace [moreover,] Furthermore, X1 as an aryl group replaced by the amino group expressed with a general formula (XII) X2 You may become the nitrogen-containing aromatic ring machine united [each other].] It comes out and what is expressed is mentioned. As the above-mentioned electron repelling group, for example Aryloxy groups, such as a phenyloxy machine, a biphenyl oxy-basis, a naphthyloxy machine, an anthranil oxy-basis, and a terphenyl yloxy machine, Alkoxy groups, such as a methoxy machine, an ethoxy basis, an isopropoxy group, a TASHARU butyloxy machine, and a pentyloxy machine, A dimethylamino machine, a diethylamino machine, a diphenylamino machine, The amino group which has hydrocarbon groups, such as a phenyl methylamino machine, a phenyl ethylamino machine, a phenylmethyl ethylamino machine, a ditolylamino machine, an ethyl phenylamino machine, a phenyl naphthyl amino group, and a phenyl biphenyl ylamino machine, is mentioned. Moreover, as an example of D1 -D12, it is [0078].

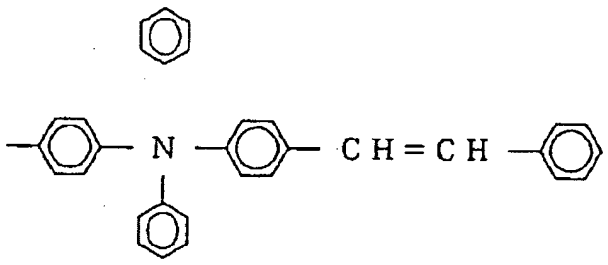
[Formula 41]



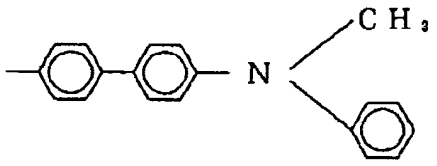
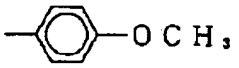
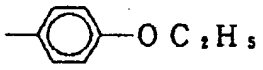
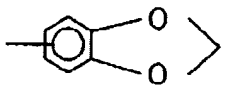
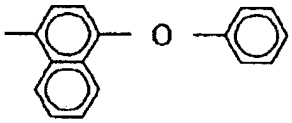
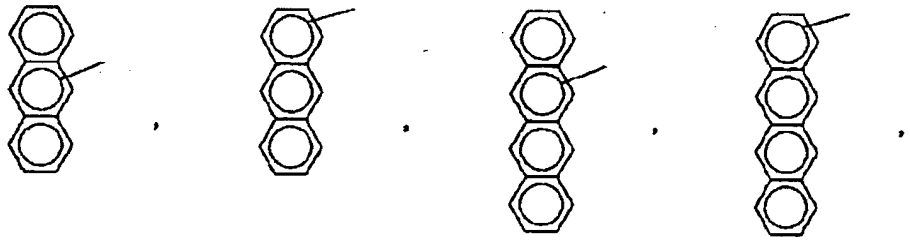
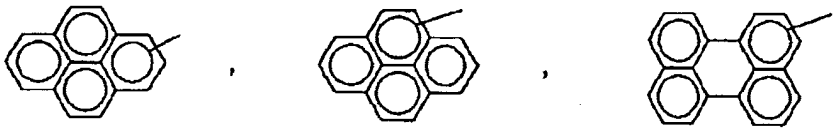






[0079]
[Formula 42]

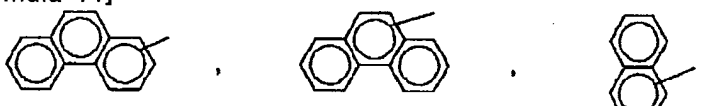











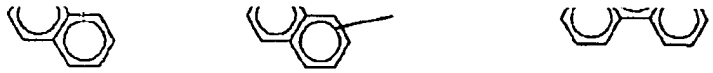


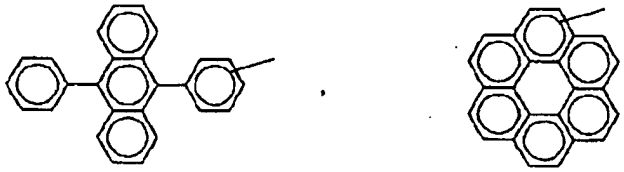
[0080]
[Formula 43]

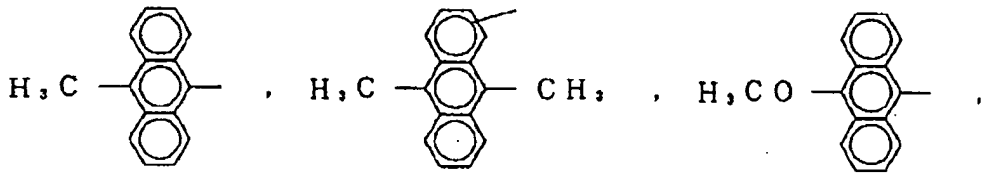








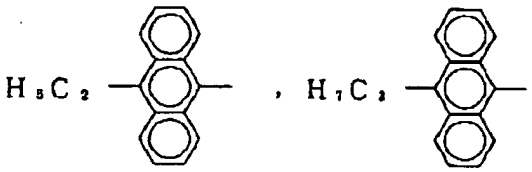
[0081]
[Formula 44]



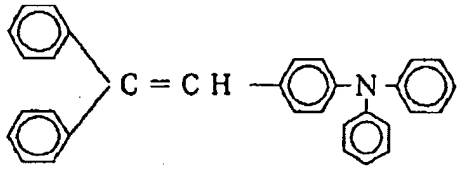


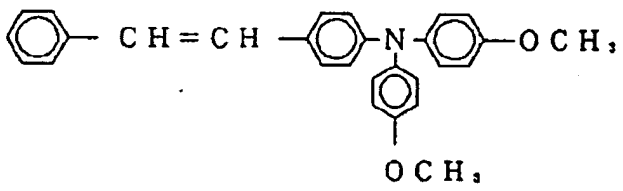


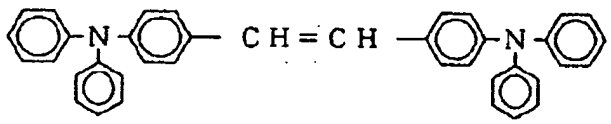


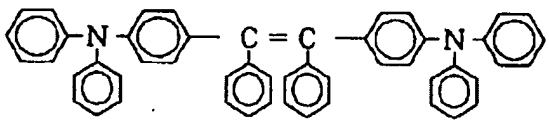
[0082] **** is mentioned. The above-mentioned general formula (IV) As an example of a compound expressed with - (X), it is [0083].

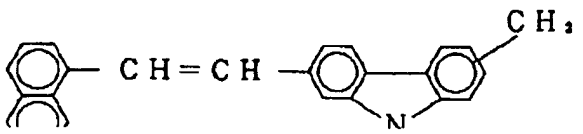
[Formula 45]

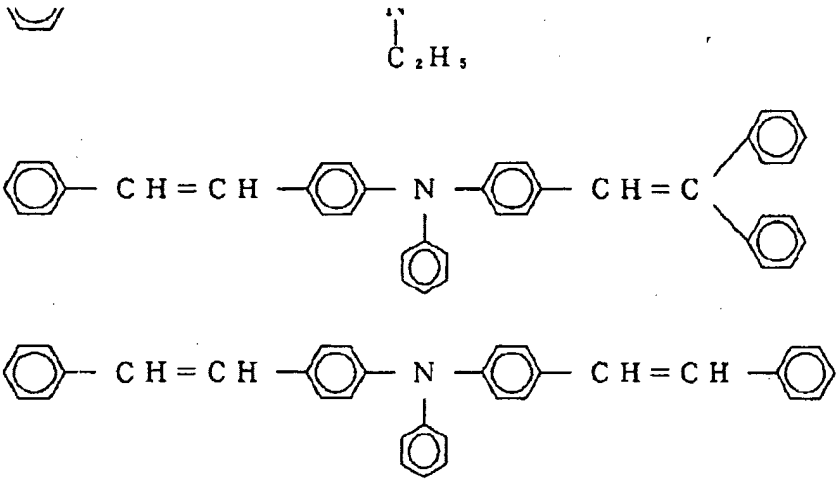




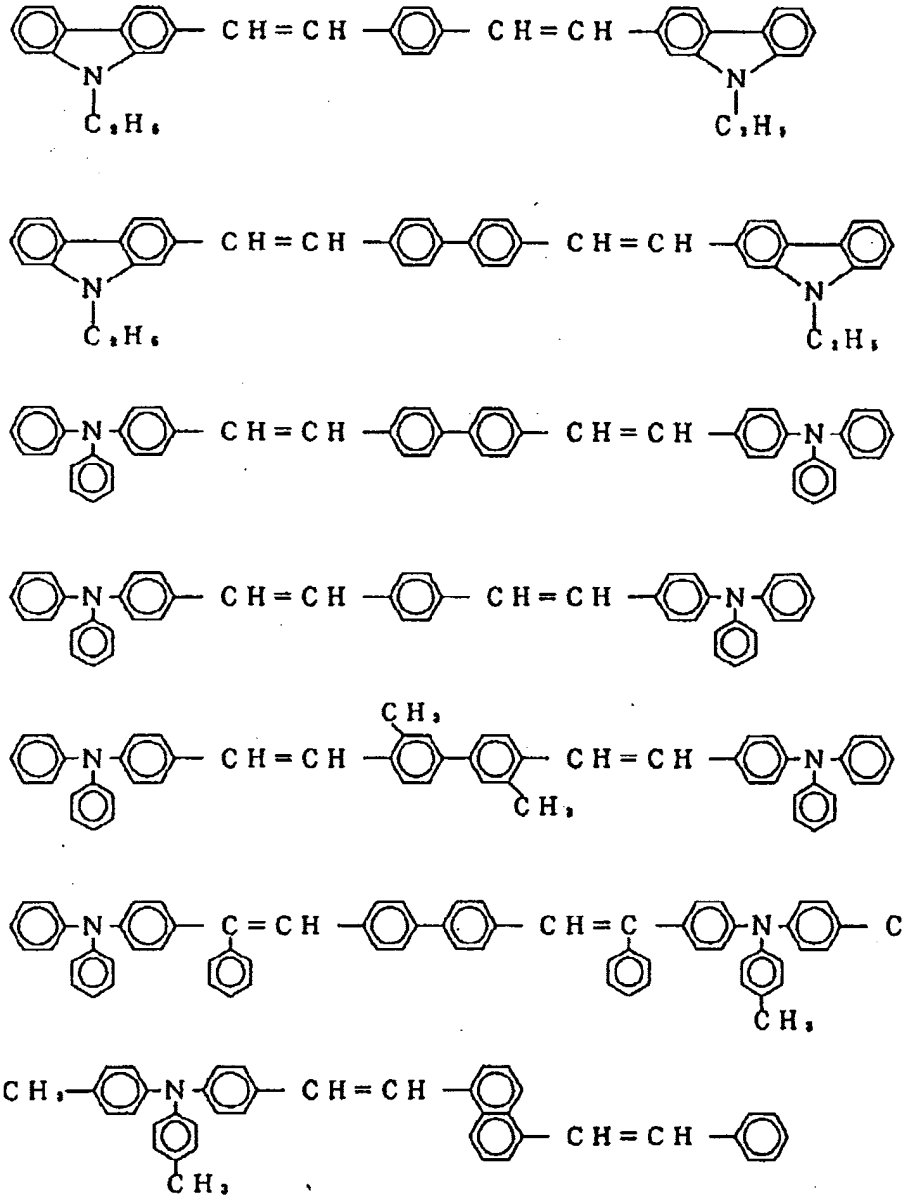




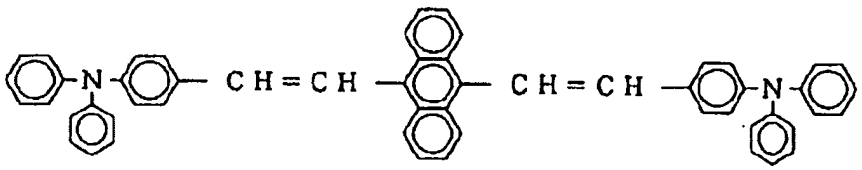


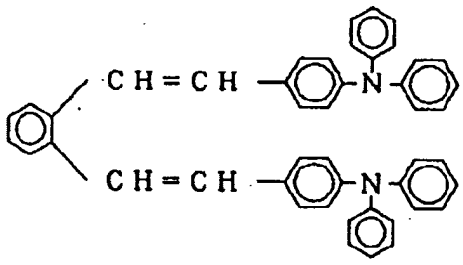


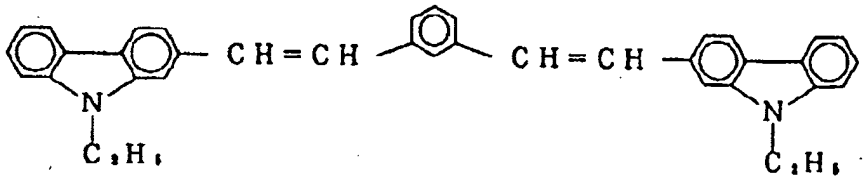
[0084]
[Formula 46]

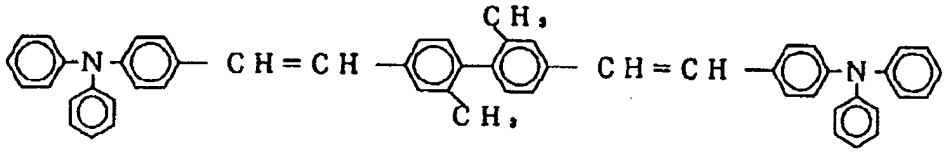


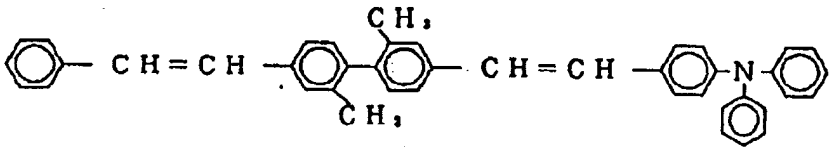
[0085]
[Formula 47]



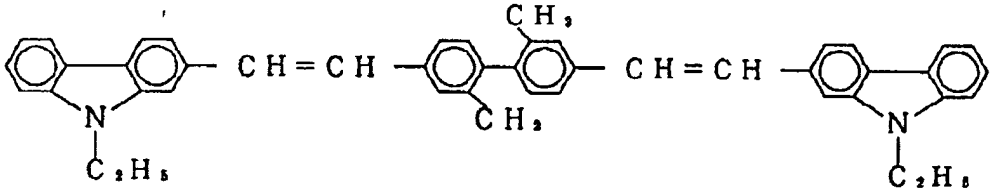


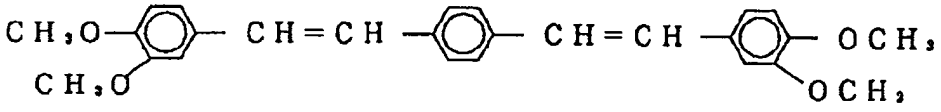


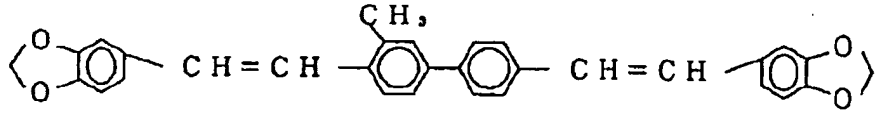


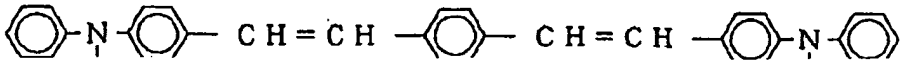


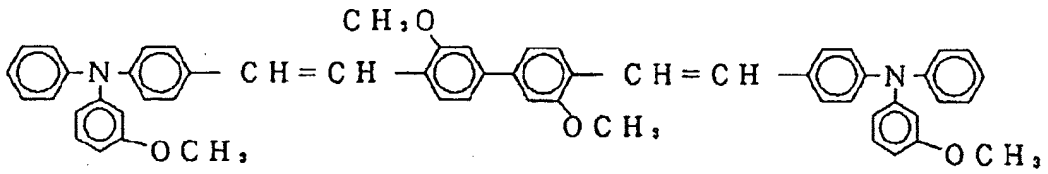
[0086]
[Formula 48]

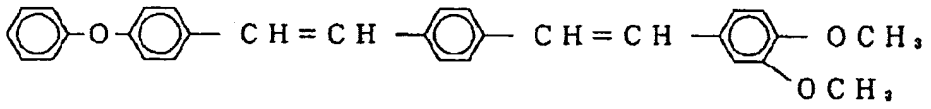


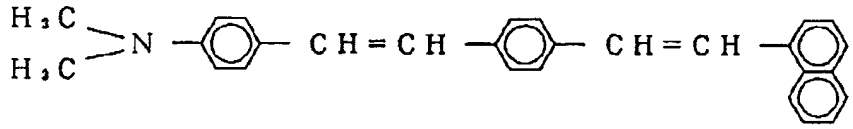




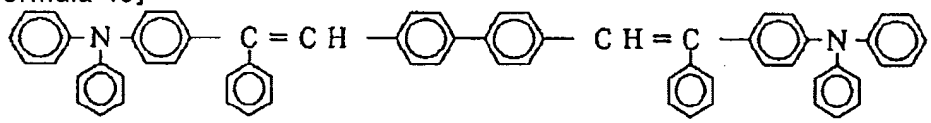


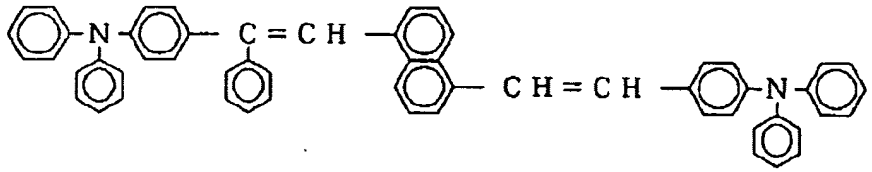


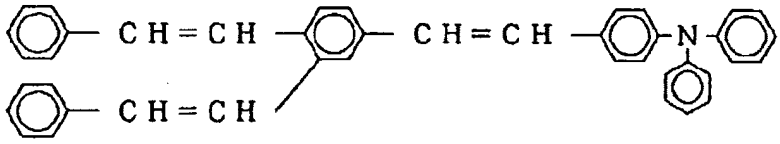


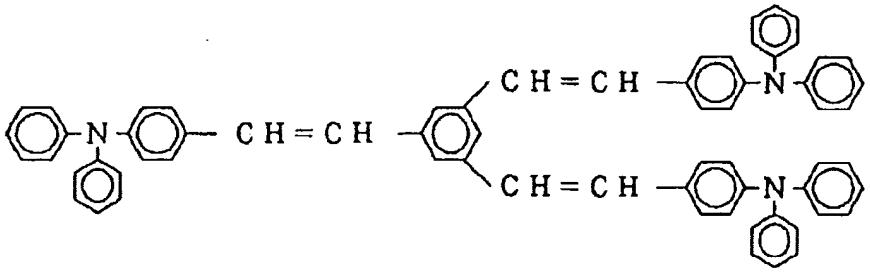


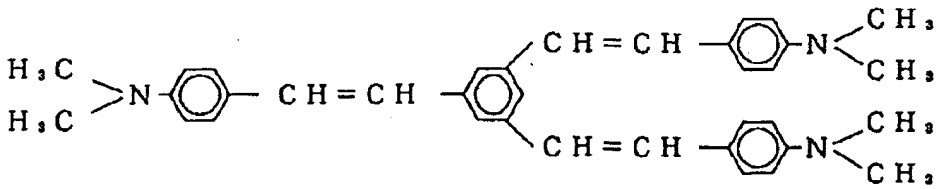
[0087]
[Formula 49]



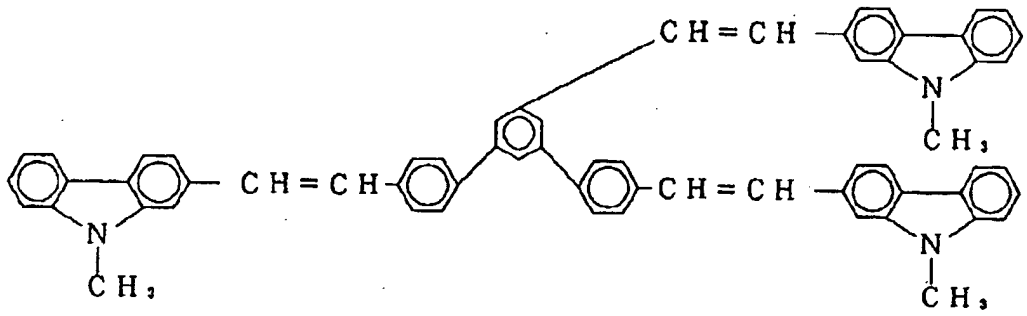


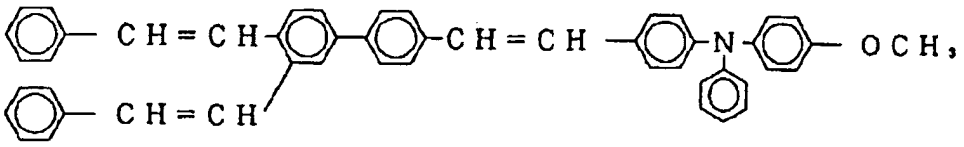


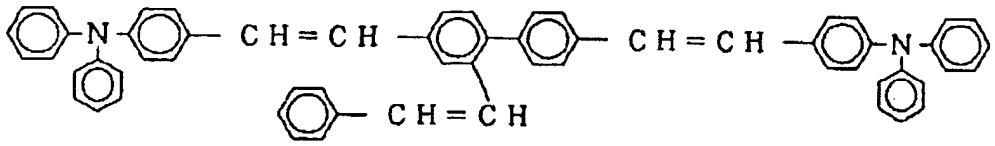




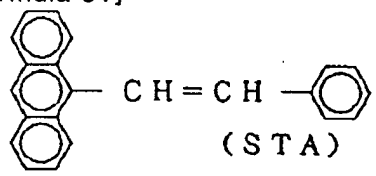
[0088]
[Formula 50]

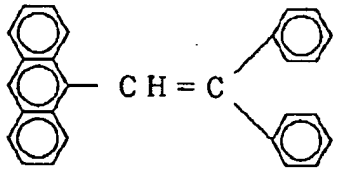


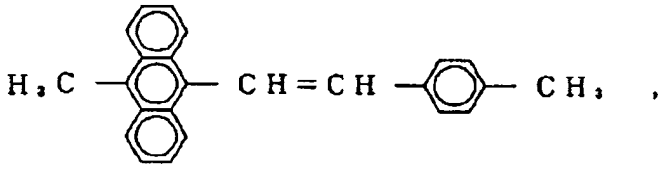


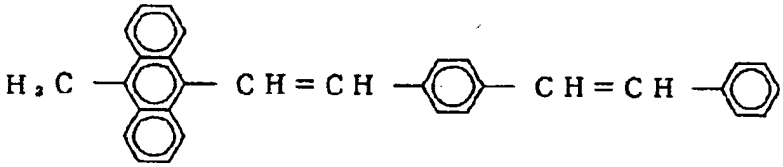


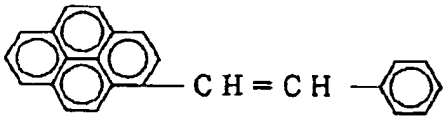
[0089]
[Formula 51]

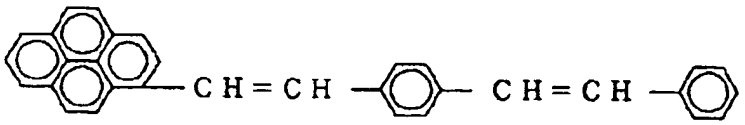

(STA)

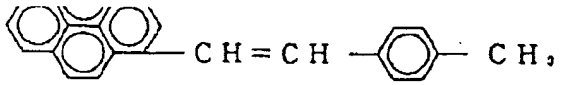




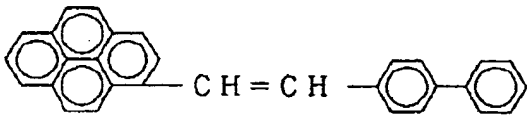



(STPy)

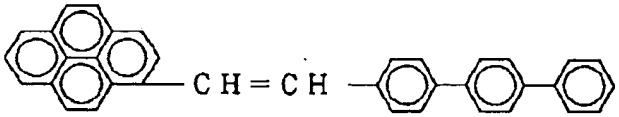

(STSTPy)

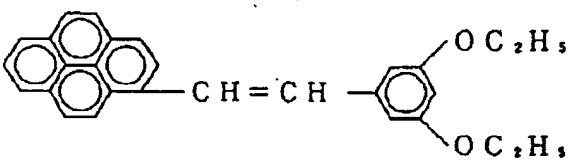


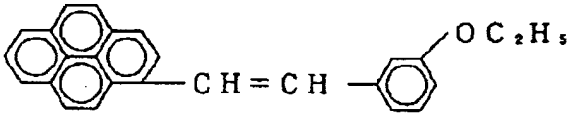
(MeSTPy)

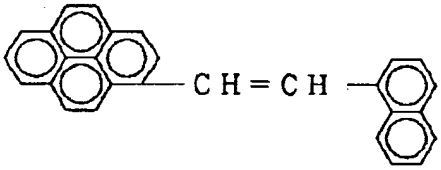


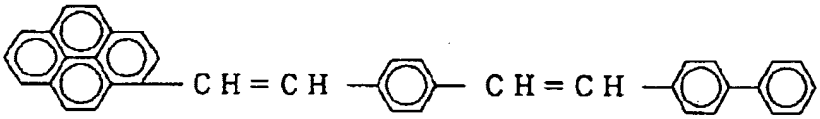
[0090]
[Formula 52]

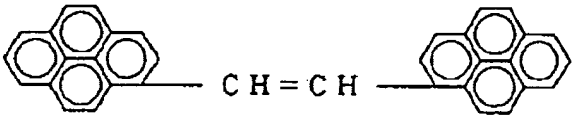


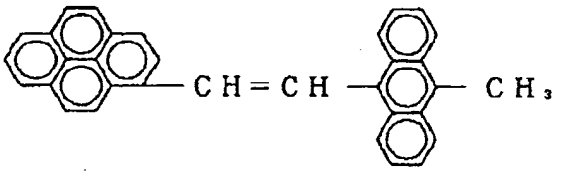




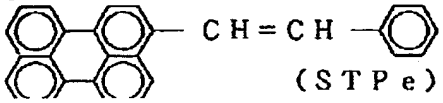




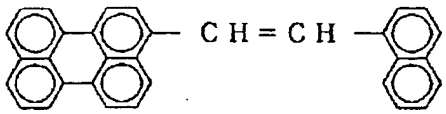


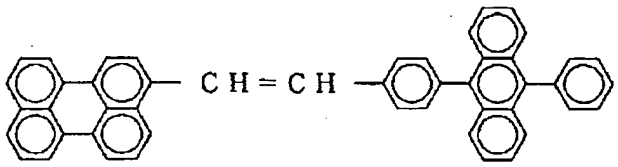


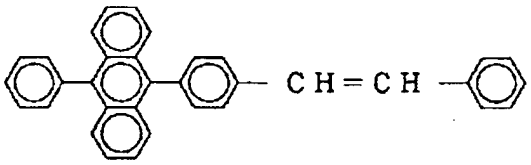
[0091]
[Formula 53]



(STPe)



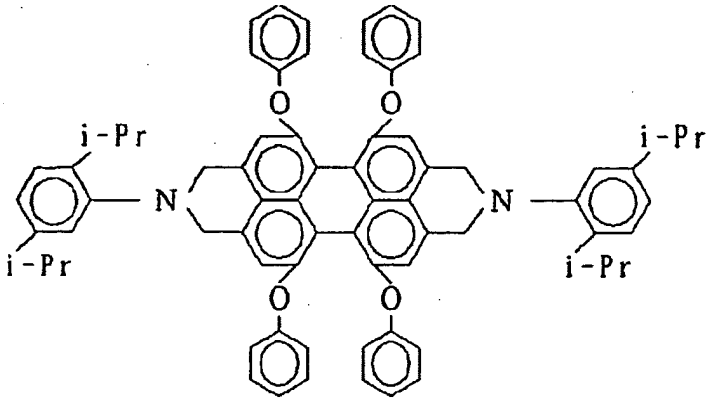




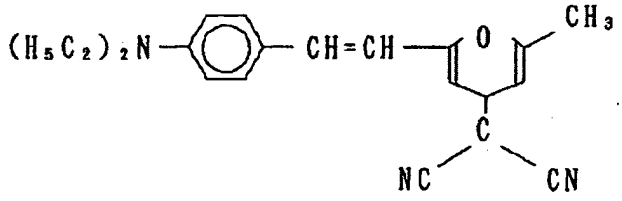
[0092] **** can be mentioned.

[0093] In the white organic EL element of this invention, the thing as which the fluorescence peak wavelength in a solution state was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers in 580nm or more organic compound it is [organic compound] 650nm or less and which is made for a monostromatic to contain at least is required. As this organic compound, that the peak wavelength in a solution state should just be 580nm or more 650nm or less, although there is especially no limit, the dicyanomethylene pyran derivative used as red start laser coloring matter indicated by the Europe public presentation patent No. 0281381 official report, for example, a dicyanomethylene thiopyran derivative, a fluorescein derivative, a perylene derivative, etc. are mentioned. Specifically, it is [0094].

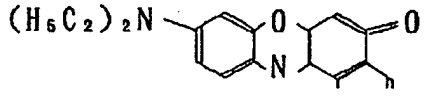
[Formula 54]



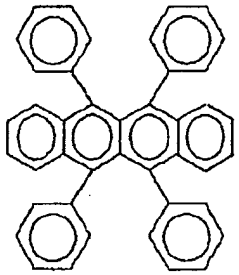
（ルモゲンＦレッド）



（ジシアノメチレンピラン）



（フェノキサゾン）



（ルブレン）

[0095] **** is mentioned. It is required that these organic compounds make it contain at 0.5-5-mol % of a rate preferably to the organic compound which forms a layer 0.1-10-mol%. These 0.1 - 10% is a density range for not producing concentration quenching.
[0096] Except the composition of a luminous layer, the composition of the white organic EL element of this invention is not limited, and can take arbitrary element composition. Concretely, each composition of an organic EL element which consists of an anode plate / hole-injection transporting bed / luminous layer / an electron-injection transporting bed / cathode is explained.
[0097] As for the white organic EL element of this invention, forming on a support substrate is desirable. As for the support substrate used, what has transparency is desirable, and, generally they are glass, transparent plastics, a quartz, etc. What makes electrode material the large (4eV or more) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as an anode plate in the white organic EL element of this invention is used preferably. As an example of such electrode material, a transparent material or translucent material with the dielectric, such as metals, such as Au, CuI, ITO and SnO2, and ZnO, are mentioned. This anode plate can produce these pole matter by making a thin film form by methods, such as vacuum evaporationo and sputtering. When taking out luminescence from this electrode, it is desirable to make permeability larger than 10%, and below hundreds ofohms / ** of the sheet resistance as an electrode are desirable. Although thickness is furthermore based also on material, 10nm - 1 micrometer is usually preferably chosen in 10-200nm.
[0098] What, on the other hand, makes electrode material the small (4eV or less) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as cathode is used. As an example of such electrode material, a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium / copper mixture, aluminum/(aluminum 2O3), an indium, the rare earth metal, etc. are mentioned. This cathode can produce such electrode material by making a thin film form by methods, such as vacuum evaporationo and sputtering. Moreover, below hundreds ofohms / ** of the sheet resistance as an electrode are desirable, and 10nm - 1 micrometer of thickness is usually preferably chosen in 50-200nm. In addition, in this EL element, in order that it may penetrate luminescence that either this anode plate or cathode is transparent or translucent, the drawing efficiency of luminescence is well convenient.
[0099] The luminous layer in this EL element has the laminated structure by which consisted of the first luminous layer of the above, and the second luminous layer, and the laminating was carried out one by one to the order of the first luminous layer and the second luminous layer from the transparent-electrode or anode plate side. It is more desirable than a luminous layer with the far luminous layer especially near a cathode side that electronic transport capacity is size. Main luminescence arises in two luminous layer interfaces, the energy of luminescence here or an excitation state is used, the organic compound whose fluorescence peak in a liquid

from a transparent electrode. When the order of a laminating of the first luminous layer and the second luminous layer becomes reverse, luminescence of the first luminous layer is absorbed by the second luminous layer, and good white is no longer obtained. Since the fluorescence peak in a liquid state is a long wavelength component, 580nm or more organic compound it is [organic compound] 650nm or less is not absorbed by other components, and it may make what layer of an organic compound layer contain it on luminescence wavelength. And the second luminous layer can choose [preferably] the thickness of a luminous layer according to a situation suitably in this range that what is necessary is just more than the thickness of the first luminous layer. Although the formation method of the above-mentioned luminous layer can be formed by not being limited, for example, thin-film-izing by well-known methods, such as a vacuum deposition, the spin coat method, the cast method, and the LB method, it is desirable that it is especially a molecule deposition film. Here, molecule deposition films are the thin film which self-possessed was carried out and was formed from the gaseous-phase state of this compound, and a film which the solid state was carried out and was formed from the solution state or liquid phase state of this compound, and this molecule deposition film can usually be classified by the difference of condensation structure and higher order structure, and the functional difference resulting from it with the thin film (molecule built up film) formed by the LB method.

[0100] Thus, the luminous layer in this invention offers the place of the reunion of the transportation function, electron, and electron hole to which the charge (an electron and electron hole) which can pour in an electron hole from an anode plate or a hole-injection transporting bed at the time of electric-field impression, and can pour an electron into it from cathode or an electron-injection transporting bed, and which pouring-functioned and was poured in is moved by the force of electric field, and has the luminescence function to tie this to luminescence etc. The luminous layer of this invention is a layer which emits light in the light. In addition, an electron hole is poured in, an electron is poured in with easy, and there may be a difference in easy. Moreover, it is desirable to move either although size may be in the transportation function in which it is expressed with an electron hole and the degree of electron transfer. Furthermore, the luminescent material used by this invention may emit light in response to supply of the excitation state by the charge recombined in other organic compound layers. Next, it is more desirable to use for improvement in luminescent ability, although the hole-injection transporting bed in the EL element of this invention was not necessarily required for this element. As this hole-injection transporting bed, the material which conveys an electron hole to a luminous layer by low electric field more is desirable, and the mobility of an electron hole is 104-106 further. If it is 10-6cm2 / bolt, and a second at least in the electric field of a bolt/cm, in addition, it is desirable. For example, in ****** material, arbitrary things can be conventionally chosen and used out of what is commonly used as a charge pouring transportation material of an electron hole, or the well-known thing used for the hole-injection transporting bed of an EL element.

[0101] As a hole-injection transporting bed, for example A triazole derivative (references, such as a U.S. Pat. No. 3,112,197 specification), An OKISA diazole derivative (references, such as the 3,189,447th number specification of the U.S. patent), An imidazole derivative (references, such as JP,37-16096,B), the poly aryl alkane derivative (the [U.S. patent] -- 3,615,402) a number specification -- this 3,820,989 a number specification -- this 3,542,544 References, such as a number specification, JP,45-555,B, a 51-10983 official report, JP,51-93224,A, a 55-17105 official report, a 56-4148 official report, a 55-108667 official report, a 55-156953 official report, and a 56-36656 official report, A pyrazoline derivative and a pyrazolone derivative (the [U.S. patent] -- 3,180,729) a number specification -- this 4,278,746 A number specification, JP,55-88064,A, a 55-88065 official report, a 49-105537 official report, a 55-51086 official report, a 56-80051 official report, a 56-88141 official report, a 57-45545 official report, a 54-112637 official report, References, such as a 55-74546 official report, A phenylenediamine derivative (references, such as the 3,615,404th number specification of the U.S. patent, JP,51-10105,B, a 46-3712 official report, a 47-25336 official

arylamine derivative (the [U.S. patent] -- 3,567,450) a number specification -- this 3,180,703 a number specification -- this 3,240,597 a number specification -- this 3,658,520 a number specification -- this 4,232,103 a number specification -- this 4,175,961 a number specification -- said -- 4,012,376 A number specification, JP,49-35702,B, a 39-27577 official report, JP,55-144250,A, a 56-119132 official report, a 56-22437 official report, and West German patent 1,110,518th References, such as a number specification An amino substitution chalcone derivative (references, such as a U.S. Pat. No. 3,526,501 specification), An oxazole derivative (thing given in the 3,257,203rd number specification of the U.S. patent etc.), A styryl anthracene derivative (references, such as JP,56-46234,A), full -- me -- non -- a derivative (references, such as JP,54-110837,A) -- a hydrazone derivative (the [U.S. patent] -- 3,717,462) References, such as a number specification, JP,54-59143,A, a 55-52063 official report, a 55-52064 official report, a 55-46760 official report, a 55-85495 official report, a 57-11350 official report, a 57-148749 official report, and JP,2-311591,A, A stilbene derivative JP,61-210363,A, a 61-228451 official report, a 61-14642 official report, a 61-72255 official report, a 62-47646 official report, a 62-36674 official report, a 62-10652 official report, and a 62-30255 official report -- References, such as a 60-93445 official report, a 60-94462 official report, a 60-174749 official report, and a 60-175052 official report, etc. can be mentioned. Furthermore, a silazane derivative (U.S. Pat. No. 4950950 specification), a polysilane system (JP,2-204996,A), an aniline system copolymer (JP,2-282263,A) and the conductive polymer oligomer shown on the Japanese-Patent-Application-No. No. 211399 [one to] specifications, especially thiophene oligomer, etc. are mentioned.

[0102] In this invention, although these compounds can be used as a material of a hole-injection transporting bed The porphyrin compound shown below (Thing given in JP,63-2956965,A etc.) And an aromatic tertiary-amine compound and a styryl amine compound (the [U.S. patent] -- 4,127,412) A number specification, JP,53-27033,A, a 54-58445 official report, a 54-149634 official report, a 54-64299 official report, a 55-79450 official report, a 55-144250 official report, a 56-119132 official report, a 61-295558 official report, It is desirable references, such as a 61-98353 official report and a 63-295695 official report, and to use this aromatic tertiary-amine compound especially.

[0103] As an example of representation of this porphyrin compound Porphin; 1, 10, 15, 20-tetrapod phenyl-21H, 23H-porphin copper (II);1, 10 and 15, 20-tetrapod phenyl 21H, 23H-porphin zinc (II);5, 10 and 15, 20-tetrakis (pentafluorophenyl)-21H, and 23H-porphin; Silicon phthalocyanine oxide; Aluminum phthalocyanine chloride; A phthalocyanine ; (Non-metal) Dilithium phthalocyanine; copper tetramethyl phthalocyanine; -- copper-phthalocyanine; -- chromium phthalocyanine; -- zinc phthalocyanine; -- lead phthalocyanine; -- titanium phthalocyanine oxide; -- magnesium phthalocyanine; -- a copper octamethyl phthalocyanine etc. is mentioned moreover, as an example of representation of this aromatic tertiary-amine compound and a styryl amine compound N, N, N', and N' - tetrapod phenyl -4 and 4' - diamino phenyl;N and N' - diphenyl-N and N' - JI (3-methylphenyl) -4 and 4' - diamino biphenyl (TPDA);2 and 2-screw (4-G p-tolylamino phenyl) propane;1 -- 1-screw (4-G p-tolylamino phenyl) cyclohexane; -- N, N, N', and N' -- the - tetrapod-p-tolyl -4 and 4'-diamino biphenyl;1 -- a 1-screw (4-G p-tolylamino phenyl)-4-phenylcyclohexane; screw Phenylmethane; (4-dimethylamino-2-methylphenyl) A screw (4-G p-tolylamino phenyl) phenylmethane;N and N' - diphenyl-N and N' - JI (4-methoxypheny) -4 and 4' - diamino biphenyl; -- N, N, N', and N' - tetrapod phenyl -4, 4'-diamino diphenyl-ether;4, and 4' - screw KUODORI phenyl; N, N, and N-TORI (Diphenylamino) Amine; 4- (p-tolyl) (G p-tolylamino)-4'-[4 Styryl] stilbene; (G p-tolylamino) 4-N, N-diphenylamino-(2-diphenyl vinyl) benzene;3-methoxy-4'-N, and N-diphenylamino still benzene;N-phenyl carbazole; an aromatic JIMECHIRI DIN system compound etc. is mentioned. Moreover, the aromatic methylidyne compound (refer to a Japanese-Patent-Application-No. No. 279304 [two to] specification and JP,3-231970,A) shown as a material of a luminous layer can also be used as a material of a hole-injection transporting bed. Furthermore, p type-Si, p type - Inorganic compounds (refer to international public presentation patent WO No. 05998 [90 to] official report), such as SiC,

[0104] The hole-injection transporting bed in the EL element of this invention can be produced by the thin film-ized method a vacuum deposition method, the spin coat method, the cast method, the LB method, etc. are well-known, and can form the above-mentioned compound. Although there is especially no limit, 1nm - 10 micrometers of thickness as this hole-injection transporting bed are usually 5nm - 5 micrometers preferably. This hole-injection transporting bed may consist of monostromatics which consist of these hole-injection transportation material kinds or two sorts or more, or may carry out the laminating of the hole-injection transporting bed which consists of a compound of another kind to the aforementioned hole-injection transporting bed.
[0105] In the white organic EL element of this invention, in order to raise the adhesion between a luminous layer and cathode, as for this electron-injection transporting bed, it is desirable to contain an adhesive high material to a luminous layer and cathode. as such an adhesive high material -- nitration full -- me -- non, heterocycle tetracarboxylic acid anhydrides, such as a derivative, an anthra quinodimethan derivative, a diphenyl quinone derivative, a thiopyran dioxide derivative, and a naphthalene perylene derivative, a carbodiimide, a full ORENIRIDEN methane derivative, an anthra quinodimethan derivative and an anthrone derivative, an OKISA diazole derivative, other specific electron-transport nature compounds, etc. can be mentioned Moreover, the metal complex (aluminum, Zn, Li, Ga, Be, In, Mg, Cu, calcium, Sn, or Pb) of 8-hydroxyquinoline or its derivative can be mentioned. Specifically, it is a metal chelate oxy-NOIDO compound containing the chelate of an oxine (generally an eight quinolinol or 8-hydroxyquinoline). Such a compound shows a high level performance and is easily fabricated by the thin film gestalt.
[0106] Furthermore, if a chelation oxy-NOIDO compound is illustrated concretely Tris Aluminum; A screw (Eight quinolinol) Magnesium; A screw (Eight quinolinol) Zinc; A screw (Benzo-8-quinolinol) (2-methyl-8-quinolilato)aluminumoxide; -- tris (eight quinolinol) indium; -- tris (5-methyl-eight quinolinol) aluminum; -- eight-quinolinol lithium; -- tris (5-chloro-eight quinolinol) gallium; -- a screw Calcium; (5-chloro-eight quinolinol) There is 5 and 7-dichloro-eight-quinolinol aluminum; tris (5, 7-dibromo-8-hydroxy quinolinol) aluminum etc. In addition, that by which a metal free-lancer or metal phthalocyanines, and those ends are replaced with the alkyl group or the sulfone machine is also desirable. Furthermore, the JISUCHIRIRU pyrazine derivative mentioned above as a material of a luminous layer can also be used as a material of an electron-injection transporting bed. Furthermore, p type-Si, p type - Inorganic compounds (refer to international public presentation patent WO No. 05998 [90 to] official report), such as SiC, can also be used as a material of an electron-injection transporting bed.
[0107] The electron-injection transporting bed in the EL element of this invention can be produced by the thin film-ized method a vacuum deposition method, the spin coat method, the cast method, the LB method, etc. are well-known, and can form the above-mentioned compound. Although there is especially no limit, 1nm - 10 micrometers of thickness as this electron-injection transporting bed are usually 5nm - 5 micrometers preferably. This electron-injection transporting bed may consist of monostromatics which consist of these electron-injection transportation material kinds or two sorts or more, or may carry out the laminating of the electron-injection transporting bed which consists of a compound of another kind to the aforementioned electron-injection transporting bed.
[0108]
[Example] Next, although an example explains this invention in more detail, this invention is not limited at all by these examples.
What manufactured ITO by 100nm thickness in the vacuum deposition on the example 1-325mmx75mmx1.1mm glass substrate was used as the transparent-electrode substrate. In isopropyl alcohol, ultrasonic cleaning was performed for 10 minutes and this substrate was immersed. This substrate was dried in dryness nitrogen, and subsequently, SAMUKO International Lab equipment (UV-300) performed UV ozone washing, and it considered as the transparent-electrode substrate. This transparent-electrode substrate is installed in the substrate electrode holder of commercial vacuum evaporationo equipment (product made

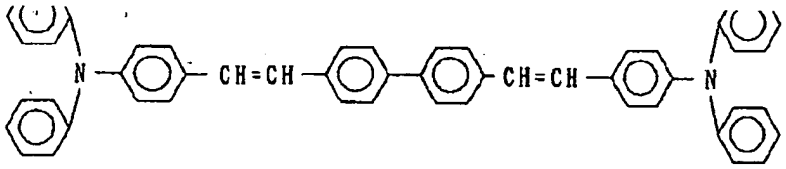
boat made from molybdenum. - N, N'-screw (3-methylphenyl)-[1 and 1'-biphenyl]-4, and 200mg (TPD) of 4'-diamines are put in. Furthermore, 200mg (DPVBi) of 4 and 4'-screw (2 and 2'-diphenyl vinyl) biphenyls was put into another resistance heating boat made from molybdenum, the compound (A) shown in the 1st table was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, the boat containing TPD was heated to 215-220 degrees C, the vacuum evaporationo of the TPD was carried out on the transparent support substrate by the 0.1-0.3nm [/second] evaporation rate, and the hole-injection transporting bed of 60nm of thickness was produced. The substrate temperature at this time was a room temperature.
[0109] Next, without taking this out, the boat by which DPVBi entered on this hole-injection transporting bed was heated, and 40nm laminating deposition was carried out as the first luminous layer. The boat of a compound (A) was heated simultaneously and the first luminous layer was made to contain at a rate of (b) mol % which shows a compound (A) in the 1st table at this time. Then, the vacuum tub was returned to atmospheric pressure, 200mg (Alq) of 8-hydroxyquinoline aluminum complexes was newly put into the resistance heating boat made from molybdenum, the compound (C) shown in the 1st table was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was again decompressed up to 1x10 to 4 Pa. Subsequently, the boat containing Alq was heated and 20nm produced the film as the second luminous layer. The boat of a compound (C) was also heated simultaneously and the second luminous layer was made to contain at a rate of (d) mol % which shows a compound (C) in the 1st table at this time. Then, the vacuum tub was again returned to atmospheric pressure, 1g of magnesium ribbons was put into the resistance heating boat made from molybdenum, 500mg of silver wires was put into the tungsten basket, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal.
[0110]
[Table 1]

第 1 表

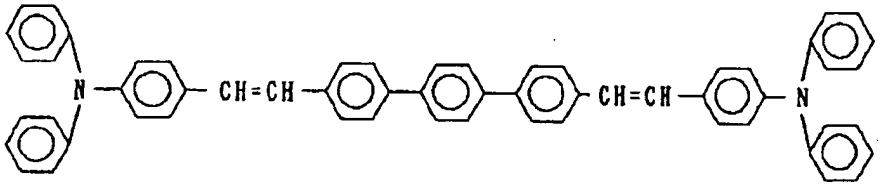
	(A) 化合物の種類	(b) (A) の含有量 (モル%)	(C) 化合物の種類	(d) (C) の含有量 (モル%)
実施例1	PAVBi	3.0	ルブレン*	0.5
実施例2	PAVTP	3.0	ルブレン	0.5
実施例3	PAVBi	3.0	ルモルゲンF	3.0

＊：アルドリッチ社製

[0111] In addition, the fluorescence peak wavelengths of each organic compound were DPVBi (solid-state):465nm, PAVBi(solid-state):463nm, PAVTP(solid-state):454nm, Alq(solid-state):500nm, rubrene (0.1 % of the weight solution of dimethylformamides):585nm, and F (0.1 % of the weight solution of dimethylformamides):595nm of RUMOGEN. Moreover, the structure expression of PAVBi and PAVTP is shown below.
[0112]
[Formula 55]
PAVBi



PAVTP



[0113] The central value and the reduction-by-half life of an initial performance of this element were searched for. The result is shown in the 2nd table. In addition, the reduction-by-half life measured on condition that initial brightness:100 cd/m2, a direct-current constant-current drive, and drive environmental:dryness nitrogen-gas-atmosphere mind, and was expressed in time which amounted to one half of initial brightness.

[0114] The same washing process as the glass substrate with ITO of the same configuration as example 4 examples 1-3 was given, and it considered as the transparent-electrode substrate, and installed in the substrate electrode holder of a vacuum tub. 200mg of TPD(s) was put into the resistance heating boat made from molybdenum, rubrene was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, the boat containing TPD was heated, the vacuum evaporationo of the TPD was carried out on the transparent support substrate by the 29-30nm [/second] evaporation rate, and the hole-injection transporting bed of 60nm of thickness was produced. the boat containing this, simultaneously rubrene -- heating -- 0.5-mol % -- it came out comparatively and the hole-injection transporting bed was made to contain rubrene The substrate temperature at this time was a room temperature. Then, it returned to atmospheric pressure at once, 200mg of DPVBi(s) was put into another resistance heating boat made from molybdenum, Compound PAVBi was put into still more nearly another boat made from molybdenum, the vacuum tub was decompressed up to 1x10 to 4 Pa, and 40nm laminating of the DPVBi was carried out as the first luminous layer on this hole-injection transporting bed. The boat containing PAVBi was heated simultaneously and this first luminous layer was made to contain PAVBi at three-mol % of a rate. Then, it returned to atmospheric pressure, 200mg of Alq(s) was newly put into the resistance heating boat made from molybdenum, 1g of magnesium ribbons was put into the resistance heating boat made from molybdenum, 500mg of silver wires was further put into the tungsten basket, the vacuum tub was decompressed up to 1x10 to 4 Pa, and 40nm produced the film by making Alq into the second luminous layer. Then, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal. The central value and the reduction-by-half life of an initial performance of this element were searched for like examples 1-3. The result is shown in the 2nd table.

[0115] The same washing process as the glass substrate with ITO of the same configuration as example 5 examples 1-3 was given, and it considered as the transparent-electrode substrate, and installed in the substrate electrode holder of a vacuum tub. 200mg of TPD(s) was put into the resistance heating boat made from molybdenum, 200mg of DPVBi(s) was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, the boat containing TPD was heated at 215-220 degrees C, the vacuum evaporationo of the TPD was carried out on the transparent

transporting bed of 60nm of thickness was made to produce. The substrate temperature at this time was a room temperature. Without taking this out from a vacuum tub, the boat by which DPVBi entered on the hole-injection transporting bed was heated at 245 degrees C, and 40nm laminating deposition was carried out as the first luminous layer. Then, the vacuum tub was returned to atmospheric pressure, 200mg of Alq(s) was newly put into the resistance heating boat made from molybdenum, RUMOGEN F red (product made from BAFUSU) was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was again decompressed up to 1x10 to 4 Pa. Subsequently, the resistance heating boat made from molybdenum containing RUMOGEN F red was heated at 330 degrees C, the boat made from molybdenum containing Alq was heated to 250 degrees C, and the 40nm of the second luminous layer was produced so that the content of RUMOGEN F red might become three-mol% to Alq. Then, the vacuum tub was decompressed up to 1x10 to 4 Pa after that by returning a vacuum tub to atmospheric pressure, putting 1g of magnesium into the resistance heating boat made from molybdenum, and putting 500mg of silver wires into the basket made from a tungsten, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal. The central value and the reduction-by-half life of an initial performance of this element were searched for like examples 1-3. The result is shown in the 2nd table.

[0116]

[Table 2]

第 2 表－1

	初期性能			
	電圧 (V)	電流密度 (mA/cm²)	発光輝度 (cd/m²)	発光効率 (ルーメン/W)
実施例1	9.5	4.5	100	0.7
実施例2	9.5	5.0	100	0.7
実施例3	10.0	7.0	100	0.4
実施例4	11.0	6.5	100	0.4
実施例5	9.8	7.5	100	0.4

[0117]

[Table 3]

第 2 表－2

	CIB色度座標 (x, y)	半減時間 (時間)
実施例1	(0.245, 0.278)	1,000
実施例2	(0.245, 0.267)	800
実施例3	(0.300, 0.320)	600
実施例4	(0.265, 0.278)	300
実施例5	(0.220, 0.240)	200

[0118] As shown in the 2nd table, compared with an example 5, the whitening and quantum yield (equivalent to brightness/current density) of examples 1-4 of the luminescent color are improving, and its luminescence stability is also improving.

[0119]

[Effect of the Invention] The white organic EL element of this invention has high luminous efficiency, and white luminescence excellent in luminescence stability is presented, and it is suitably used as a light emitting device in various display.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] Luminous efficiency of this invention is high in more detail about new white organic electroluminescent element, and it is related with the organic electroluminescent element which presents white luminescence excellent in luminescence stability.

[Translation done.]

PRIOR ART

[Description of the Prior Art] For self-luminescence, visibility of electroluminescent element (EL element) is high, and since it is a perfect solid-state component, it has the feature of excelling in shock resistance. Therefore, various EL elements using inorganic or the organic compound are proposed, and utilization is tried now. Since an organic EL element can reduce applied voltage sharply among these elements, development of various material and elements is furthered. Furthermore, it is effective also in lightweight-izing of display devices, such as a back light, a display, etc. which are used now. About the organic EL element which carries out white luminescence, although the indication of the following technology was made conventionally, there were the following troubles plentifully. For example, in the Europe public presentation patent No. 0390551 official report, in order to incorporate a carrier by tunneling pouring by accumulation of a carrier interface, the threshold-limit-value voltage for carrying out white luminescence exists, and since it is not white, a gradation display is not made to below the threshold limit value. In JP,3-230584,A, since it is mixed luminescence of the fluorescence object of a two color, it does not become good white. although white luminescence is presented in JP,2-220390,A -- applied-voltage 30V -- brightness 110 cd/m2 it is -- a rate with high driver voltage -- luminous efficiency -- low In JP,4-51491,A, it is end-face luminescence structure and is unsuitable for the use as the whole field.
[0003]

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] The white organic EL element of this invention has high luminous efficiency, and white luminescence excellent in luminescence stability is presented, and it is suitably used as a light emitting device in various display.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] While this invention is the basis of such a situation and maintaining the property of the conventional organic EL element, luminous efficiency is high, and it is made for the purpose of offering the organic EL element which presents white luminescence excellent in luminescence stability.

[Translation done.]

MEANS

[Means for Solving the Problem] As a result of repeating research wholeheartedly that this invention persons should develop the white organic EL element which has high luminous efficiency and luminescence stability, the recombination field of an electron hole and an electron as an interface field of the first luminous layer and the second luminous layer The organic compound in the specific range from which the fluorescence peak wavelength of a solid state differs in the first luminous layer and each second luminous layer is made to contain. And by making a monostromatic contain at least the organic compound which was chosen from the first luminous layer, the second luminous layer, and other organic compound layers and which has the fluorescence peak wavelength in a solution state in the specific range While maintaining the property of the conventional organic EL element, luminous efficiency was high and it found out that the organic EL element which presents white luminescence excellent in luminescence stability was obtained. this invention is completed based on this knowledge. Namely, this invention is set to the organic electroluminescent element to which at least one side comes to pinch the organic compound layer which contains a luminous layer in inter-electrode [of a transparent or translucent couple] at least. The first luminous layer in which, as for this luminous layer, the fluorescence peak wavelength of a solid state contains 380nm or more organic compound it is [organic compound] less than 480nm, The second luminous layer in which the fluorescence peak wavelength of a solid state contains 480nm or more organic compound it is [organic compound] less than 580nm consists of a laminated structure by which the laminating was carried out one by one from the transparent-electrode or anode plate side. The fluorescence peak wavelength in a solution state and 580nm or more organic compound it is [organic compound] 650nm or less The white organic electroluminescent element characterized by making a monostromatic contain at 0.1-10-mol % of a rate to the organic compound which was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers, and which forms the layer at least is offered.

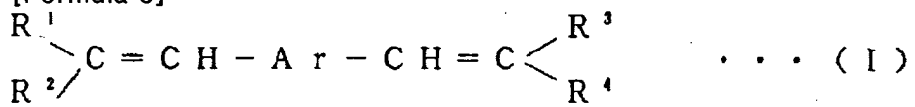
[0005] The white organic EL element of this invention has the feature in the two-layer luminous layer of the first luminous layer and the second luminous layer. The organic compound 380nm or more less than (blue system) 480nm of whose fluorescence peak wavelengths of a solid state is 420nm or more less than 475nm preferably is used for this first luminous layer, and the organic compound 480nm or more less than (green system) 580nm of whose fluorescence peak wavelengths of a solid state is 490nm or more less than 560nm preferably is used for the second luminous layer at it. Furthermore, fluorescence peak wavelength in a solution state is preferably characterized by % and 580nm or more 650nm or less (red system) of 0.1-10-mol making it contain at 0.5-5-mol % of a rate preferably at a monostromatic to the organic compound which forms the layer for 585nm or more organic compound which is 620nm or less chosen from the above-mentioned luminous layer and other organic compound layers at least. This 0.1-10-mol % is a density range for not producing concentration quenching. In addition, in the fluorescence spectrum, the peak should just have at least one peak in each above-mentioned whole wavelength surface region in the compound which has more than one.

[0006] The white light by the white organic EL element of this invention can be acquired by the superposition (namely, superposition of three-primary-colors luminescence of three kinds

of above-mentioned organic compounds which has specific fluorescence peak wavelength) of luminescence from the first luminous layer of the above, the second luminous layer, and a mixed component. In addition, the CIE coordinate showed the definition of the white light to drawing 1 . Here, what satisfies the fluorescence conditions of the first luminous layer of the above in the organic compound which especially the organic compound used for the first luminous layer is not limited, for example, is indicated by JP,3-231970,A or the international public presentation patent WO 92/No. 05131 official report, the Japanese-Patent-Application-No. No. 170354 [five to] specification, and the Japanese-Patent-Application-No. No. 129438 [five to] specification is mentioned. What satisfies the fluorescence conditions of the first luminous layer of the above in the compound used for the combination of what fulfills the fluorescence conditions of the first luminous layer of the above indicated by JP,3-231970,A, the international public presentation patent WO 92/No. 05131 official report, and the Japanese-Patent-Application-No. No. 170345 [five to] specification as a desirable thing, and the suitable compound indicated by the Japanese-Patent-Application-No. No. 129438 [five to] specification, and the hole-injection transporting bed mentioned further later can be mentioned. Next, as a compound which fulfills the fluorescence conditions of the first luminous layer of the above indicated by JP,3-231970,A and the international public presentation patent WO 92/No. 05131 official report, it is a general formula (I).

[0007]

[Formula 6]

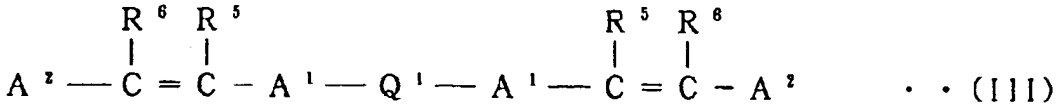


[0008] R1 -R4 shows among [formula the pyridyl machine which is not replaced [the aryloxy group of the carbon numbers 6-18 which are not replaced / the cyclohexyl machine which is not replaced / the aromatic heterocycle formula machine which is not replaced / the aryl group of the carbon numbers 6-18 which are not replaced / a hydrogen atom, the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or /, substitution, or /, substitution, or /, substitution Here, a substituent shows the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, the aryloxy group of carbon numbers 6-18, the acyl group of carbon numbers 1-6, the acyloxy machine of carbon numbers 1-6, a carboxyl group, a styryl machine, the aryl carbonyl group of carbon numbers 6-20, the aryloxy carbonyl group of carbon numbers 6-20, the alkoxy carbonyl group of carbon numbers 1-6, a vinyl group, the Ernie Reno carbonyl group, a carbamoyl group, Even if these substituents are single, plural is sufficient as them. Moreover, R1 -R4 Even if the same, it may differ mutually, and it is R1. R2 And R3 R4 It may combine with the basis replaced mutually and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation substitution, or] or an unsaturation may be formed. Ar expresses the arylene machine of the carbon numbers 6-20 which are not replaced [substitution or], and even if single substitution is carried out, it replaces them -- having -- **** -- moreover, a bonding site -- ORUTO and Para -- meta-- - any are sufficient [two or more] In addition, the substituent is the same as the above. Moreover, the substituents of an arylene machine may join together and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation, substitution, or] or an unsaturation may be formed. However, it is R1 -R4 when Ar is a non-replaced phenylene. It is chosen out of the naphthyl group which is not replaced [the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or], a biphenyl machine, a cyclohexyl machine, and an aryloxy group, respectively.] The aromatic methylidyne compound, general formula (II) which are come out of and expressed

A-Q-B ... Among (II) [formula, A and B show the monovalent machine excluding one hydrogen atom from the compound expressed with the above-mentioned general formula (I), respectively, and even if the same, they may differ. Moreover, Q shows the bivalent machine

with which conjugated system is cut.] The aromatic methylidyne compound and general formula [0009] which are come out of and expressed (III)

[Formula 7]



[0010] A1 shows among [formula the arylene machine or the bivalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or]. Any of ORUTO, meta, and Para are sufficient as a joint position. A2 The aryl group or the monovalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or] is shown. R5 And R6 The aryl group of the carbon numbers 6-20 which are not replaced [a hydrogen atom, substitution, or], a cyclohexyl machine, a monovalent aromatic heterocycle formula machine, the alkyl group of carbon numbers 1-10, the aralkyl machine of carbon numbers 7-20, or the alkoxy group of carbon numbers 1-10 is shown, respectively. In addition, R5 and R6 You may differ, even if the same. Here, a substituent may be a phenyl group which it does not have or it has an alkyl group, an aryloxy group, amino groups, or these bases, and even if this substituent is single, plural is sufficient as it. R5 Each substituent is A1. It may join together, the five membered ring or six membered ring of saturation or an unsaturation may be formed, and it is R6 similarly. Each substituent is A2. It may join together and the five membered ring or six membered ring of saturation or an unsaturation may be formed. Moreover, Q1 It is the same as the above.] It comes out and the aromatic methylidyne compound expressed is mentioned.

[0011] here -- R1 -R4 in a general formula (I) You may differ, even if the same like the above-mentioned. Respectively A hydrogen atom, the alkyl group of carbon numbers 1-6 (a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, a tert-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, iso hexyl machine), The alkoxy group of carbon numbers 1-6 (a methoxy machine, an ethoxy basis, a propoxy group, butoxy machine, etc.), The aralkyl machines (a benzyl, phenethyl machine, etc.) of carbon numbers 7-18, the aryl group of carbon numbers 6-18 (a phenyl group, a biphenyl machine, naphthyl group, etc.), A cyclohexyl machine, an aromatic heterocycle formula machine (a pyridyl machine, quinolyl machine), and the aryloxy groups (a phenoxy machine, a biphenyl oxy-basis, naphthyloxy machine, etc.) of carbon numbers 6-18 are shown.

[0012] Moreover, R1 -R4 What the substituent combined with these may be used. Namely, R1 -R4 A substituent content phenyl group, a substituent content aralkyl machine, a substituent content cyclohexyl machine, a substituent content biphenyl machine, and a substituent content naphthyl group are shown, respectively. Here A substituent The alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, the aryloxy group of carbon numbers 6-18, the acyl group of carbon numbers 1-6, the acyloxy machine of carbon numbers 1-6, a carboxyl group, a styryl machine, They are the aryl carbonyl group of carbon numbers 6-20, the aryloxy carbonyl group of carbon numbers 6-20, the alkoxy carbonyl group of carbon numbers 1-6, a vinyl group, the Ernie Reno carbonyl group, a carbamoyl group, a phenyl group, a nitro group, a hydroxyl group, or a halogen atom. More than one may be replaced. Therefore, for example, a substituent content aralkyl machine An alkyl group substitution aralkyl machine (a methyl benzyl, methyl phenethyl machine, etc.), An alkoxy-group substitution aralkyl machine (a methoxybenzyl machine, ethoxy phenethyl machine, etc.), An aryloxy group substitution aralkyl machine (a phenoxy benzyl, naphthyloxy phenethyl machine, etc.), Phenyl group substitution aralkyl machines (phenyl phenethyl machine etc.) and the above-mentioned substituent content phenyl group An alkyl group substitution phenyl group (a tolyl group, a dimethylphenyl machine, ethyl phenyl group, etc.), They are alkoxy-group substitution phenyl group (methoxypheny machine, ethoxy phenyl group, etc.) aryloxy group substitution phenyl groups (a phenoxyphenyl machine, naphthyloxy phenyl group, etc.) or a phenyl group substitution phenyl group (getting it blocked biphenylyl

machine). Moreover, substituent content cyclohexyl machines are alkyl group substitution cyclohexyl machines (a methyl cyclohexyl machine, a dimethyl cyclohexyl machine, ethyl cyclohexyl machine, etc.), alkoxy-group substitution cyclohexyl machines (a methoxy cyclohexyl machine, ethoxy cyclohexyl machine, etc.) or an aryloxy group substitution cyclohexyl machine (a phenoxy cyclohexyl machine, naphthyloxy cyclohexyl machine), and a phenyl group substitution cyclohexyl machine (phenyl cyclohexyl machine). Substituent content naphthyl groups are alkyl group substitution naphthyl groups (a methyl naphthyl group, dimethyl naphthyl group, etc.), alkoxy-group substitution naphthyl groups (a methoxy naphthyl group, ethoxy naphthyl group, etc.) or an aryloxy group substitution naphthyl group (a phenoxy naphthyl group, naphthyloxy naphthyl group), and a phenyl group substitution naphthyl group (phenyl naphthyl group).

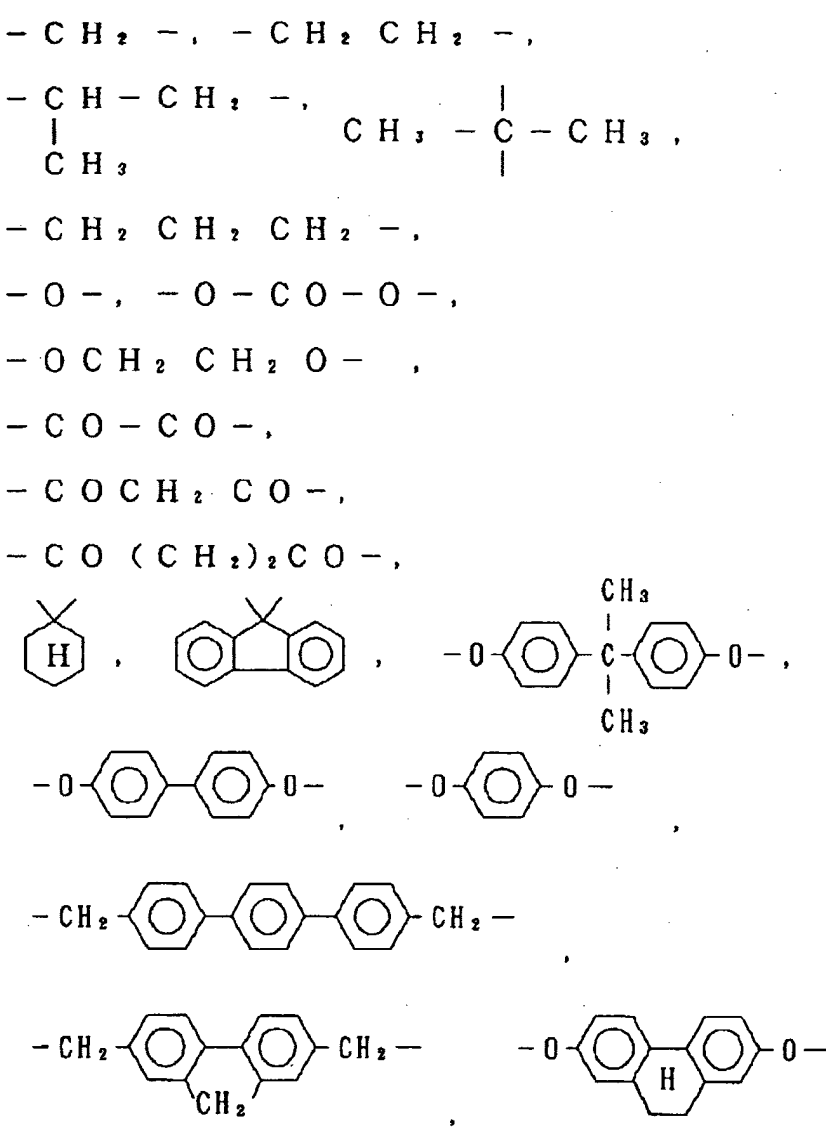
[0013] above-mentioned R1 -R4 ****** -- the alkyl group of carbon numbers 1-6, an aryloxy group, a phenyl group, a naphthyl group, a biphenyl machine, and a cyclohexyl machine are desirable respectively among what was mentioned above Any which are not replaced [substitution or] are sufficient as these. Moreover, R1 -R4 Even if the same, it may differ mutually, and it is R1. R2 And R3 R4 It may combine with the basis replaced mutually and the six membered ring of the saturation which is not replaced [the five membered ring of the saturation which is not replaced / substitution or / or an unsaturation substitution, or] or an unsaturation may be formed.

[0014] On the other hand, Ar in a general formula (I) expresses the arylene machine of the carbon numbers 6-20 which are not replaced [substitution or], are arylene machines, such as the phenylene group which is not replaced [substitution or], a biphenylene machine, p-Tell phenylene group, a naphthylene machine, a terphenylene machine, a naphthalene diyl machine, an anthracene diyl machine, a phenanthrene diyl machine, and a phenalene diyl machine, and may be replaced also in no replacing. Moreover, the joint position of methylidyne (=C=CH-) of ORUTO, meta, and Para etc. is good anywhere. However, it is R1 -R4 when Ar is a non-replaced phenylene. It is chosen out of the naphthyl group which is not replaced [the alkoxy group of carbon numbers 1-6, the aralkyl machine of carbon numbers 7-18, substitution, or], a biphenyl machine, a cyclohexyl machine, and an aryloxy group. A substituent An alkyl group (a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, iso hexyl machine, etc.), An alkoxy group (a methoxy machine, an ethoxy basis, a propoxy group, an isopropoxy group, a butyloxy machine, an isobutyloxy machine, a sec-butyloxy machine, t-butyloxy machine, an isopentyloxy machine, t-pentyloxy machine), Aryloxy groups (a phenoxy machine, naphthyloxy machine, etc.), an acyl group (a formyl machine, an acetyl group, a propionyl machine, butyryl machine, etc.), An acyloxy machine, an aralkyl machine (a benzyl, phenethyl machine, etc.), It is a phenyl group, a hydroxyl group, a carboxyl group, the Ernie Reno carbonyl group, a carbamoyl group, an aryloxy carbonyl group, a methoxycarbonyl group, an ethoxycarbonyl machine, a butoxycarbonyl machine, a nitro group, and a halogen atom, and more than one may be replaced also in single substitution.

[0015] The methylidyne aromatic compound expressed with the aforementioned general formula (I) has two methylidyne (=C=CH-) machines, and the combination of a combination [four kinds of], i.e., SHISU-SHISU, transformer-SHISU, and SHISU-transformer and a transformer-transformer is in 1 molecule with the geometrical isomerism of this methylidyne machine. The first luminous layer in the EL element of this invention may be which those things, and what the geometrical isomer mixed is sufficient as it. It is the thing of a transformer object altogether especially preferably. Moreover, it may join together between substituents and the above-mentioned substituent may form the five membered ring or six membered ring of the saturation which is not replaced [substitution and] or an unsaturation.

[0016] A and B in a general formula (II) show the monad excluding one hydrogen atom from the compound expressed with the above-mentioned general formula (I), respectively, and even if the same, they may differ. Here, Q in a general formula (II) shows the bivalent machine with which conjugated system is cut. Here, conjugate contains what depends on the un-existing-

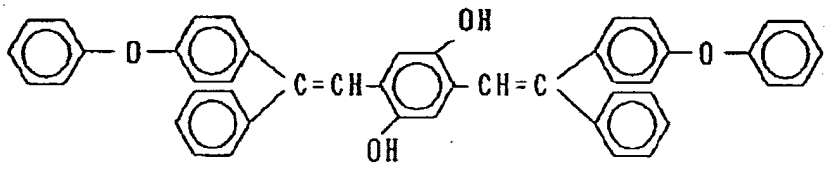
locally nature of a pi electron, and is depended on conjugated double bond, an unpaired electron, or a lone-pair electrons. As an example of Q, it is [0017].
[Formula 8]

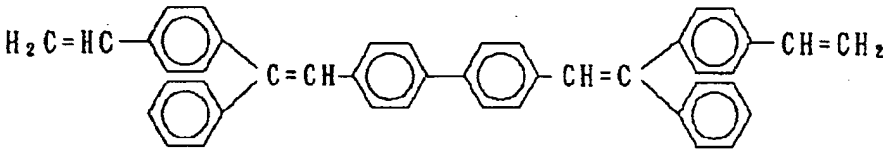


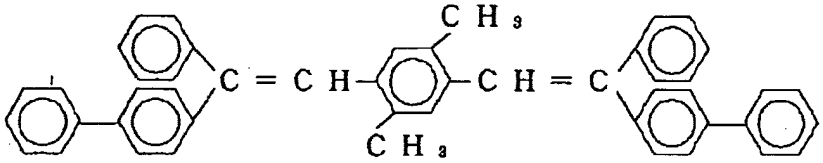
[0018] **********. Thus, the reason using the bivalent basis which cuts conjugated system is for making it EL luminescent color obtained when A or B (namely, compound of a general formula (I)) shown above is independently used as an organic EL element of this invention, and EL luminescent color obtained when the compound expressed with a general formula (II) is used as an organic EL element of this invention not change. That is, it is for making it short wavelength-ization or not form [of the first luminous layer expressed with a general formula (I) or a general formula (II)] long wavelength. Moreover, if it connects with the bivalent machine with which conjugated system is cut, it can check going up, a uniform pinhole free-lancer's microcrystal or amorphous nature thin film can be obtained, and the glass transition temperature (Tg) will raise luminescence homogeneity. Furthermore, composition or refining is equipped with the advantage made easily, without EL luminescence forming long wavelength by having joined together with the bivalent machine with which conjugated system is cut.
[0019] Moreover, A1 in a general formula (III) The arylene machine of the carbon numbers 6-20 which are not replaced [substitution or] or a bivalent aromatic heterocycle formula machine, and A2 The aryl groups (the phenyl group, the biphenyl machine, naphthyl group, etc.) or the monovalent aromatic heterocycle formula machine of carbon numbers 6-20 which is not replaced [substitution or] is shown. R5 And R6 They are the aryl group of the carbon

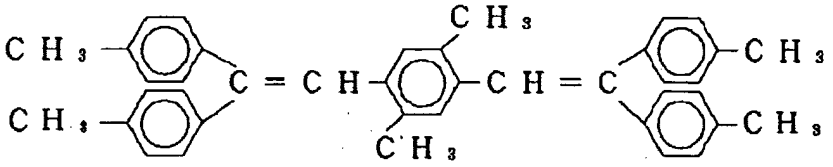
numbers 6-20 which are not replaced [a hydrogen atom, substitution, or], a cyclohexyl machine, a monovalent aromatic heterocycle formula machine, and the alkyl group () of carbon numbers 1-10, respectively. [a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl an isobutyl machine,] [sec] - Butyl, Tert-Butyl, Isopentyl Machine, T-Pentyl Machine, Neopentyl Machine, Iso Hexyl Machine, Etc., The aralkyl machines (a benzyl, phenethyl machine, etc.) of carbon numbers 7-20 or the alkoxy groups (a methoxy machine, an ethoxy basis, a propoxy group, butoxy machine, etc.) of carbon numbers 1-10 are shown. In addition, R5 and R6 You may differ, even if the same. Here, a substituent may be a phenyl group which it does not have or it has an alkyl group, an aryloxy group, amino groups, or these bases, and even if this substituent is single, plural is sufficient as it. R5 Each substituent is A1. It may join together, the five membered ring or six membered ring of saturation or an unsaturation may be formed, and it is R6 similarly. Each substituent is A2. It may join together and the five membered ring or six membered ring of saturation or an unsaturation may be formed. Moreover, Q expresses the bivalent machine with which conjugate is cut like the above. furthermore -- this -- A1 Any of ORUTO, meta, and Para are sufficient as combination. Furthermore, in this invention, the organic compound expressed with a general formula (I), an above-mentioned general formula (II), or an above-mentioned general formula (III) needs to be the compound which presents luminescence of the purple-blue in a CIE chromaticity coordinate, ****, blue, copper rust, or bluish green. Specifically, it is [0020].

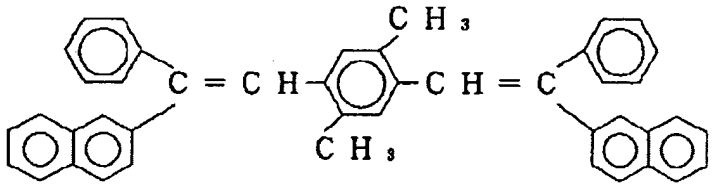
[Formula 9]

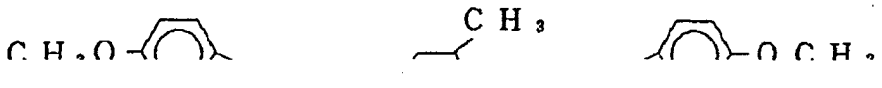


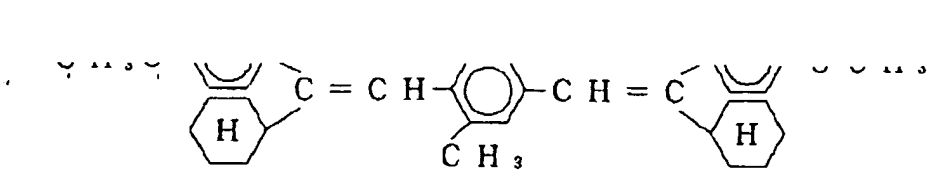




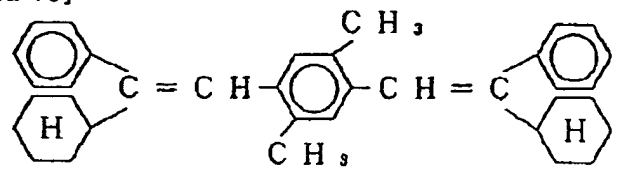


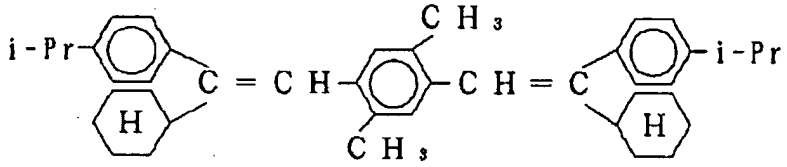




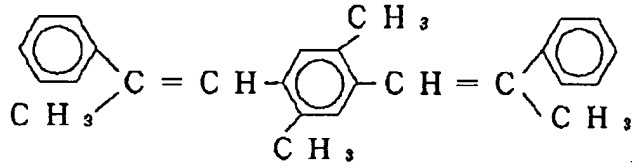


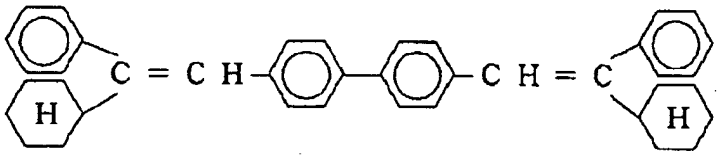
[0021]
[Formula 10]

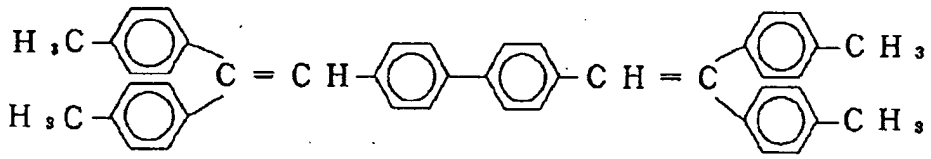


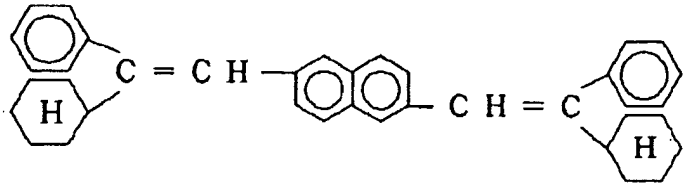


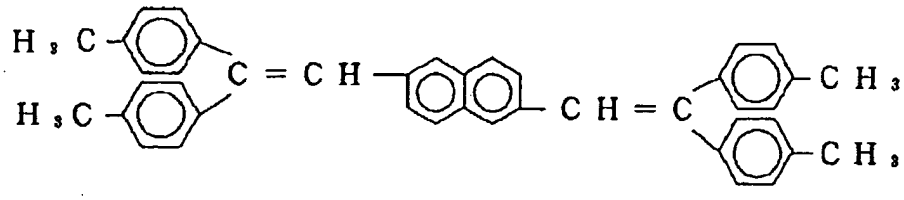
i-Pr ：イソプロピル基，以下同様



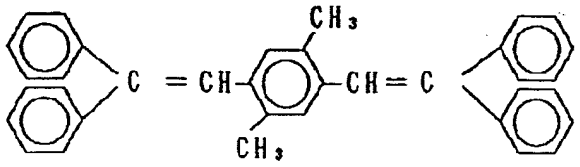


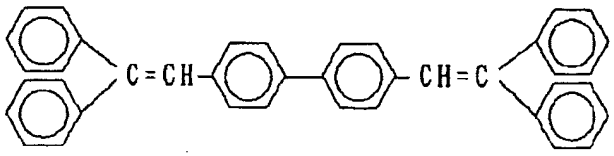


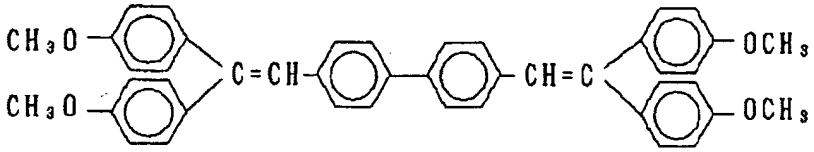


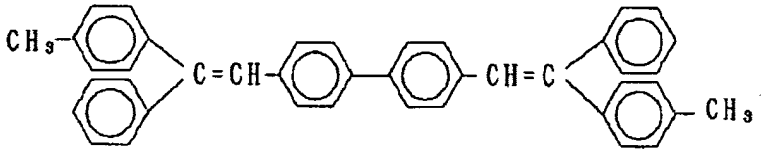


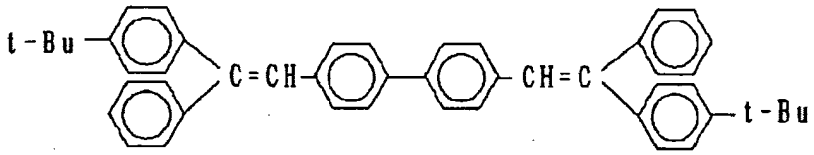
[0022]
[Formula 11]



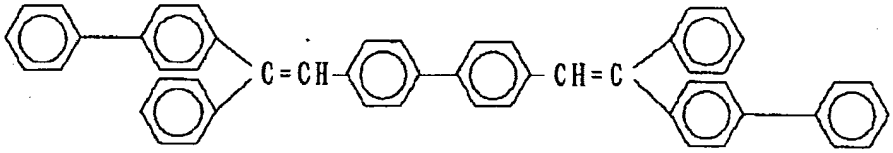




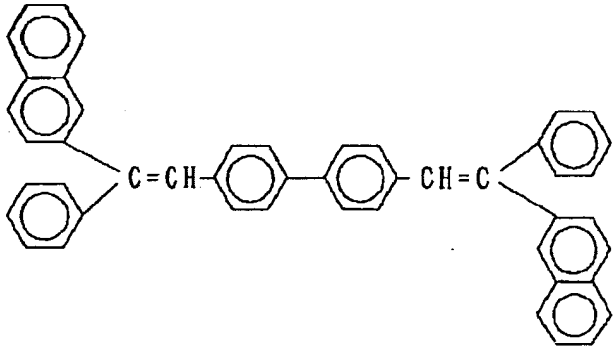


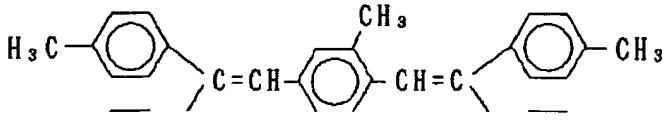


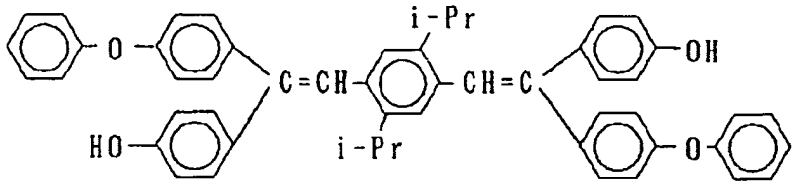
t-Bu：ｔ－ブチル基，以下同様

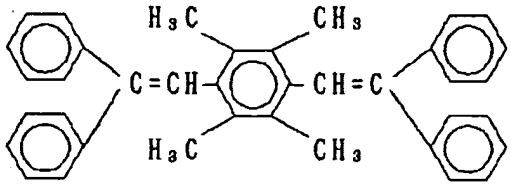


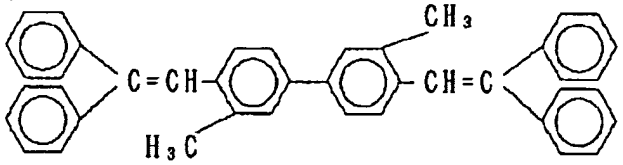
[0023]
[Formula 12]



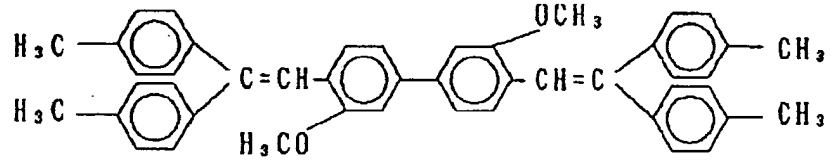


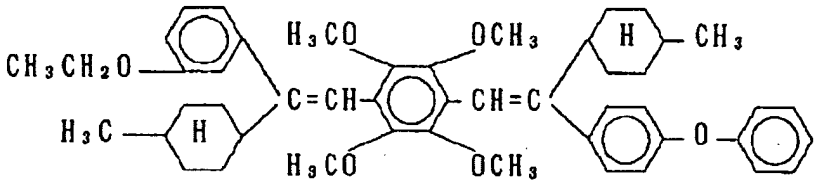


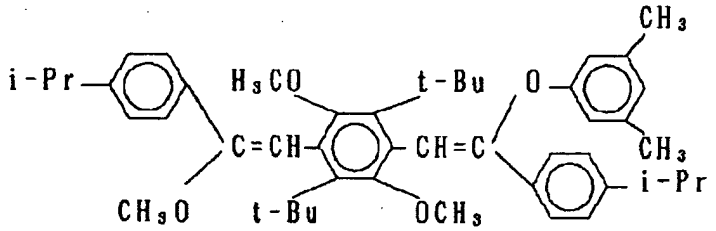


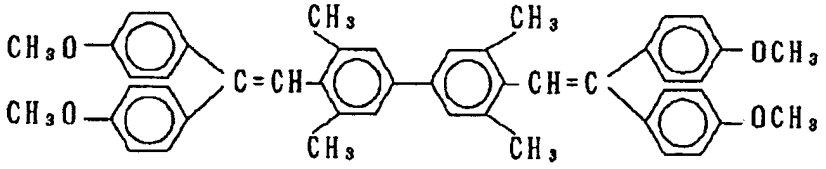


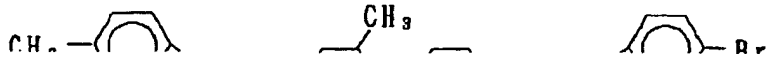
[0024]
[Formula 13]

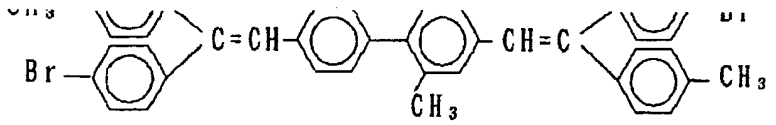




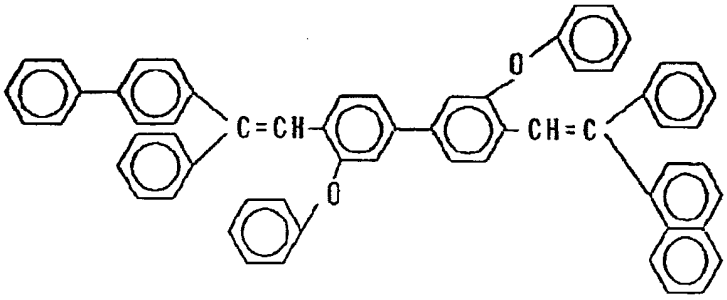


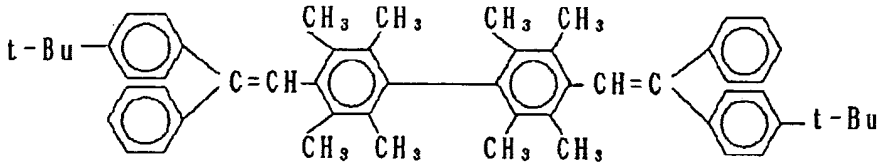


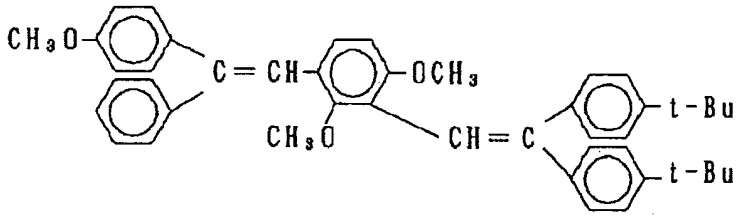


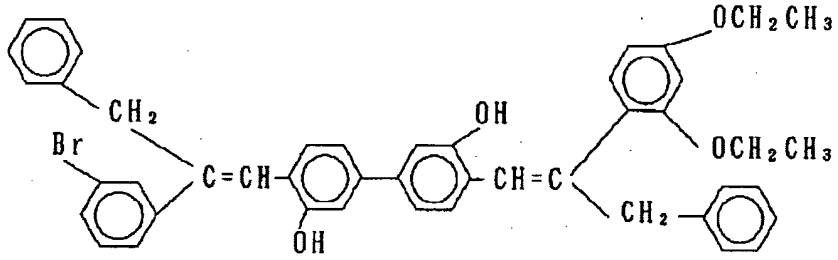


[0025]
[Formula 14]

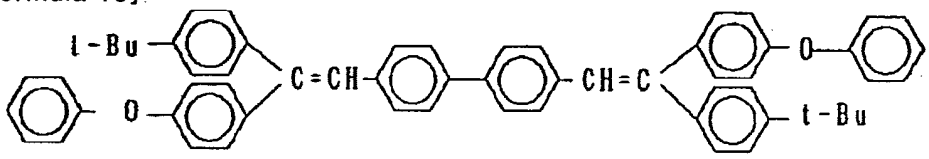


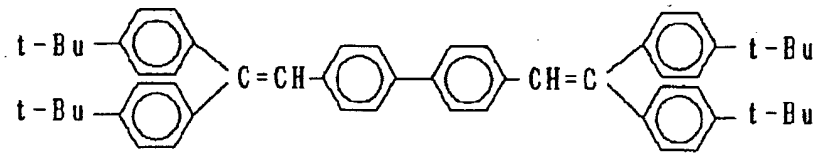


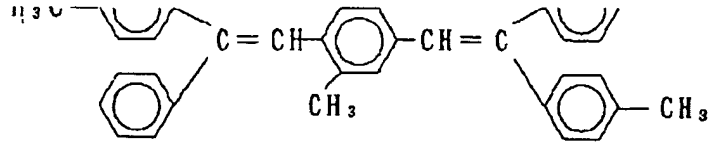


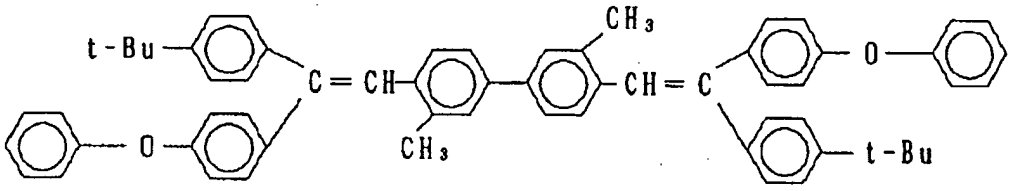


[0026]
[Formula 15]



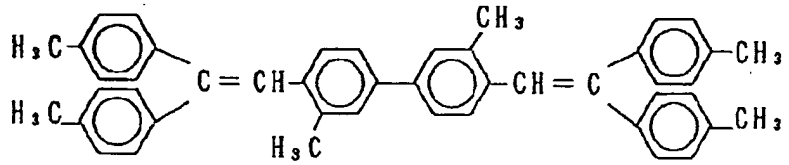


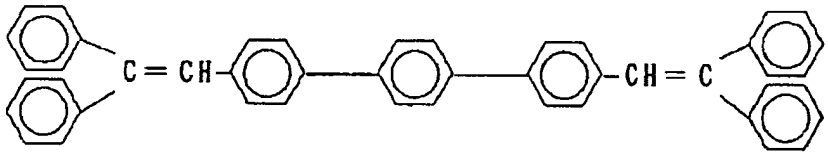


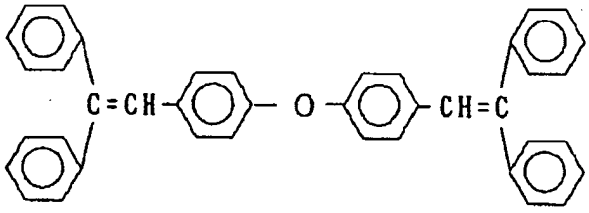


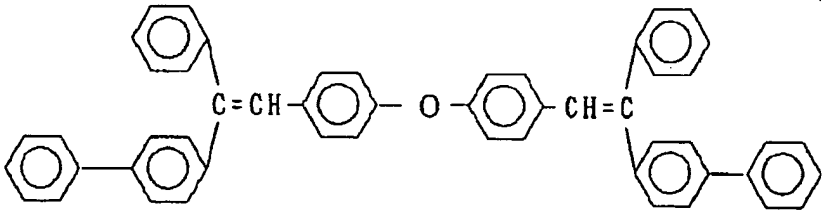
[0027]

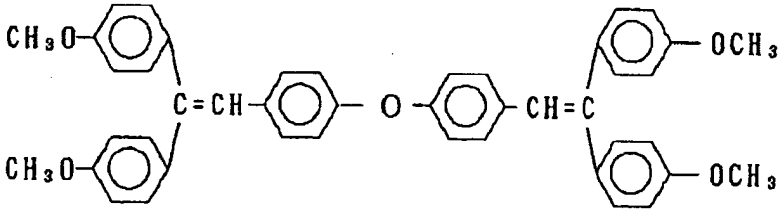
[Formula 16]





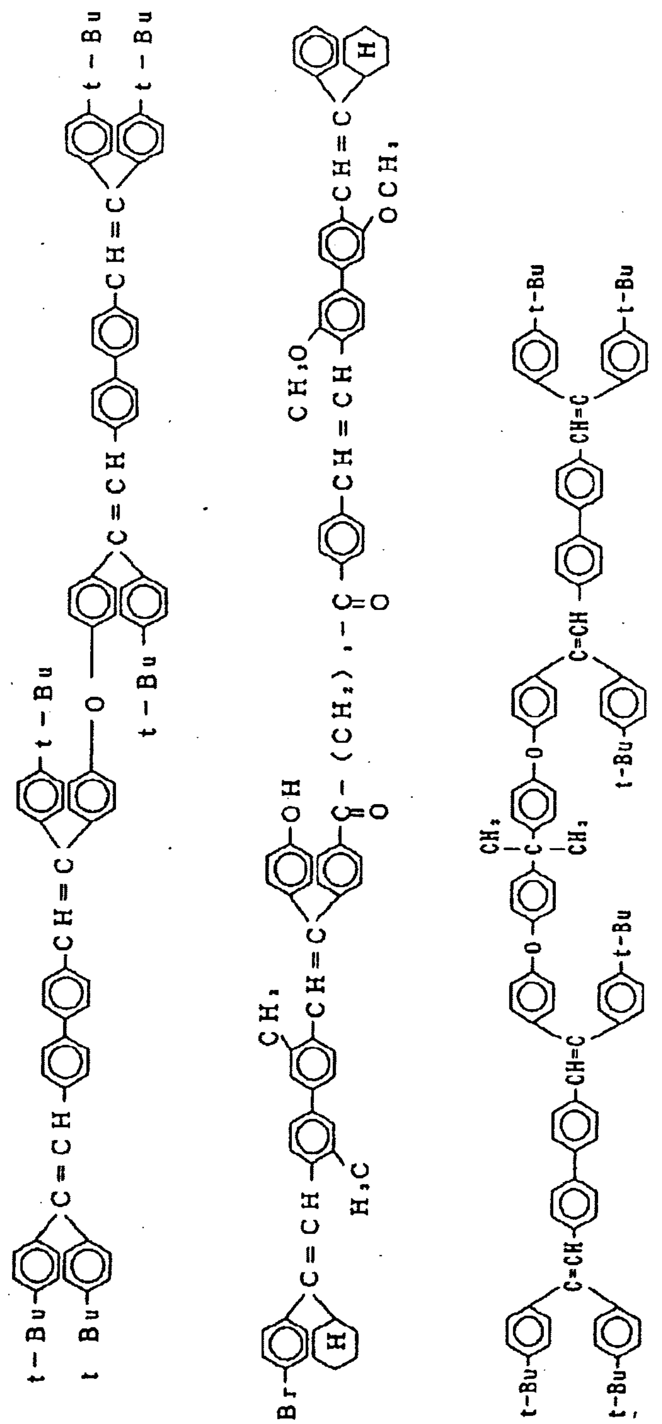






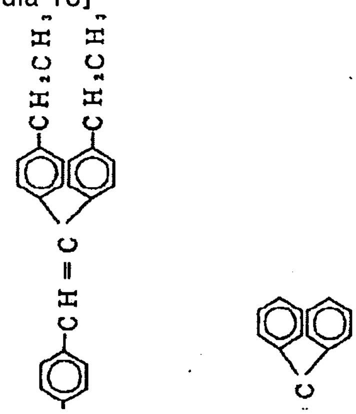
[0028]

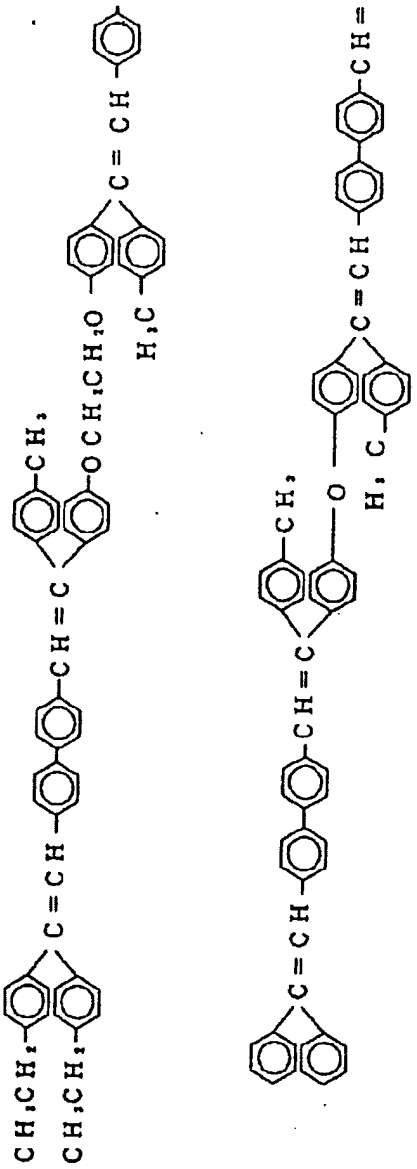
[Formula 17]



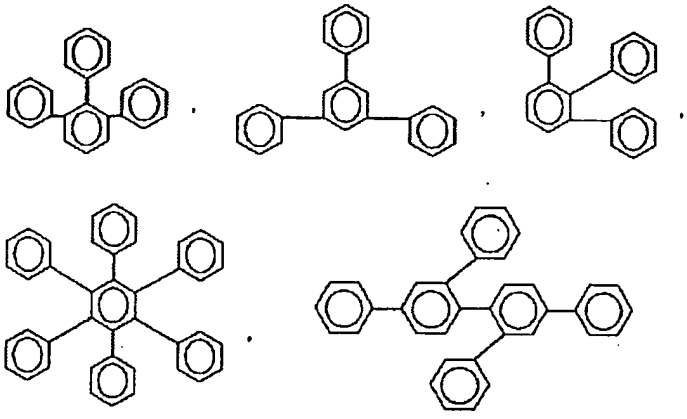
[0029]

[Formula 18]





[0030] It is ****. As other organic compounds, it is [0031].
[Formula 19]



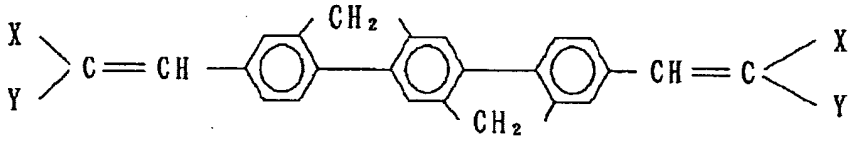
[0032] **** is also mentioned. Moreover, as a compound which fulfills the fluorescence conditions of the first luminous layer of the above indicated by the Japanese-Patent-Application-No. No. 170354 [five to] specification, it is general formula (XI) [0033].
[Formula 20]

R^{43} R^{44} R^{45} R^{46} R^{47} R^{48}

[0034] R37-R48 show a hydrogen atom or the alkyl group of carbon numbers 1-6 independently among [formula, respectively. However, at least one of R37-R48 is the alkyl group of carbon numbers 1-6. Moreover, it may join together mutually and R38, R39 and R40, R41 and R44, and R45, R46 and R47 may form the five membered ring or six membered ring of saturation or an unsaturation. X and Y show independently the aryl group of the carbon numbers 6-20 which are not replaced [substitution or], respectively. X and Y may combine with a substituent and may form the five membered ring or six membered ring of the saturation which is not replaced [substitution or] or an unsaturation. Here, as a substituent, the alkyl group of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, the aryloxy group of carbon numbers 6-18, a phenyl group, the amino group, a cyano group, a nitro group, a hydroxyl group, or a halogen atom is shown. Two or more these substituents may be replaced even if single.] It can come out and the styryl compound of the terphenylene derivative expressed can be mentioned.

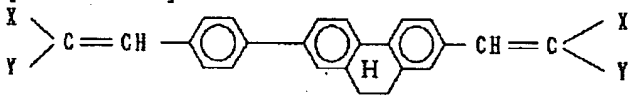
[0035] Here, in a general formula (XI), R37-R48 show the alkyl group of the carbon numbers 1-6, such as a hydrogen atom or a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, n-hexyl machine, and an iso hexyl machine, independently, respectively. However, at least one of R37-R48 is the alkyl group of carbon numbers 1-6, and especially its methyl group or ethyl group is desirable. Moreover, it may join together mutually and R38, R39 and R40, R41 and R44, and R45, R46 and R47 may form the six membered ring of the five membered ring of saturation or an unsaturation, saturation, or an unsaturation. As an example of the styryl compound which has the five membered ring or six membered ring of saturation or an unsaturation, when R38, R39, and R46 and R47 form a saturation five membered ring, it is [0036].

[Formula 21]



[0037] It is [0038], when **** is mentioned and it forms a saturation six membered ring by R46 and R47.

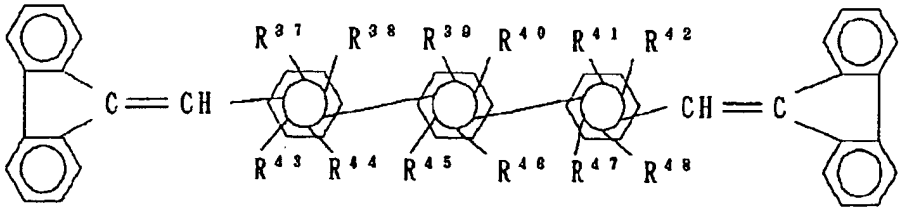
[Formula 22]



[0039] **** is mentioned. X and Y show independently aryl groups of carbon numbers 6-20, such as the phenyl group which is not replaced [substitution or], a naphthyl group, a biphenyl machine, a terphenyl machine, an ANTORARIRU machine, a phenan tolyl group, a pyrenyl machine, and a peri RENIRU machine, respectively. Here as a substituent For example, the alkyl group of the carbon numbers 1-6, such as a methyl group, an ethyl group, n-propyl group, an isopropyl machine, n-butyl, an isobutyl machine, a sec-butyl, t-butyl, an isopentyl machine, t-pentyl machine, a neopentyl machine, n-hexyl machine, and an iso hexyl machine The alkoxy group of the carbon numbers 1-6, such as a methoxy machine, an ethoxy basis, n-propoxy group, an isopropoxy group, n-butyloxy machine, an isobutyloxy machine, a sec-butyloxy machine, an isopentyloxy machine, a t-pentyloxy machine, and an n-hexyloxy machine The aryloxy group of carbon numbers 6-18, a phenyl group, the amino group, a cyano group, a nitro group and hydroxyl groups, such as a phenoxy machine and a naphthyloxy machine, or a halogen atom is mentioned. Two or more these substituents may be replaced even if single. Moreover, X and Y may combine with a substituent and may form the six membered ring of the five membered ring of the saturation which is not replaced [substitution

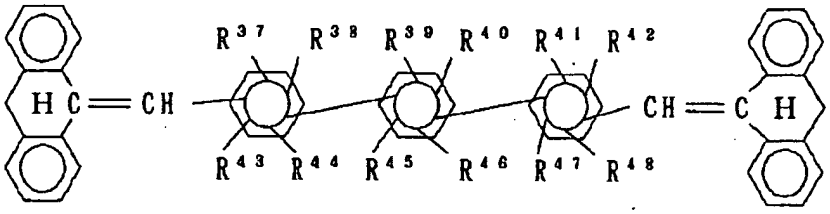
which has the five membered ring or six membered ring of saturation or an unsaturation, when X and Y form a saturation five membered ring, it is [0040].

[Formula 23]



[0041] It is [0042], when **** is mentioned and X and Y carry out saturation six membered ring formation.

[Formula 24]



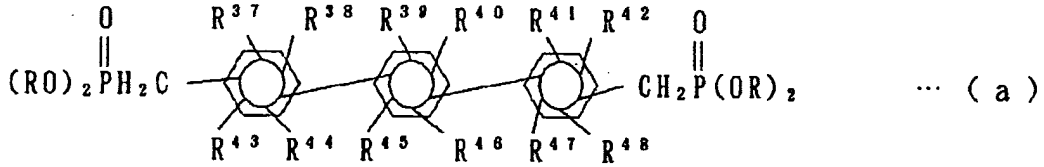
[0043] **** is mentioned.

[0044] The styryl compound expressed with the above-mentioned general formula (XI) can be manufactured by various well-known methods. Specifically, the following two methods are mentioned.

Method 1 general formula (a)

[0045]

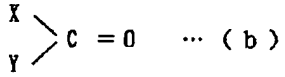
[Formula 25]



[0046] R shows the alkyl group or phenyl group of carbon numbers 1-4 among [formula, and R37-R48 are the same as the above.] The phosphonate come out of and expressed, and a general formula (b)

[0047]

[Formula 26]



[0048] X and Y are the same as the above among [formula.] It is compoundable by the method (a Wittig reaction or Wittig-Horner reaction) of coming out and condensing the carbonyl compound expressed under base existence.

Method 2 general formula (c)

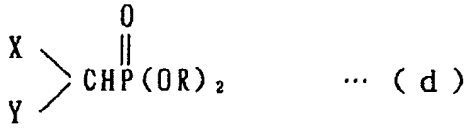
[0049]

[Formula 27]

[0050] R37-R48 are the same as the above among [formula.] The dialdehyde compound and general formula (d) which are come out of and expressed

[0051]

[Formula 28]



… (d)

[0052] R, X, and Y are the same as the above among [formula.] It is compoundable by the method (a Wittig reaction or Wittig-Horner reaction) of coming out and condensing the phosphonate expressed under base existence.

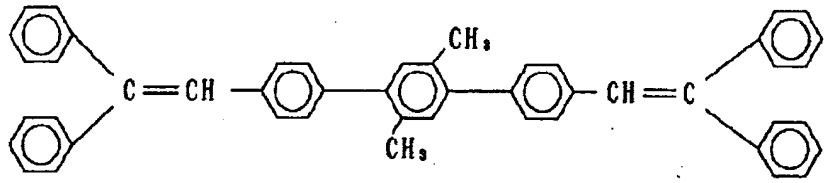
[0053] As a reaction solvent used by this composition, a hydrocarbon, alcohols, and ether are desirable. Specifically, methanol; ethanol; isopropanol; butanol; 2-methoxyethanol;1, 2-dimethoxyethane; screw (2-methoxy ethyl) ether; dioxane; tetrahydrofuran; toluene; xylene; dimethyl sulfoxide; N.N-dimethylformamide;N-methyl pyrrolidone;1, and 3-dimethyl-2-imidazolidinone etc. is mentioned. Especially, a tetrahydrofuran and dimethyl sulfoxide are suitable. Moreover, as a condensing agent, a sodium hydroxide, a potassium hydroxide, a sodium amide, a sodium hydride, n-butyl lithium, a sodium methylate, potassium-t-butoxide, etc. are desirable, and n-butyl lithium and potassium-t-butoxide are especially desirable. Although reaction temperature changes with kinds of reaction raw material to be used etc. and cannot be defined uniquely, it can usually specify the large area to 0 degree C - about 100 degrees C. It is the range of 0 degree C - a room temperature especially preferably.

[0054] Although example [of the above-mentioned styryl compound used for below by this invention] (1) - (26) is mentioned, this invention is not limited to them.

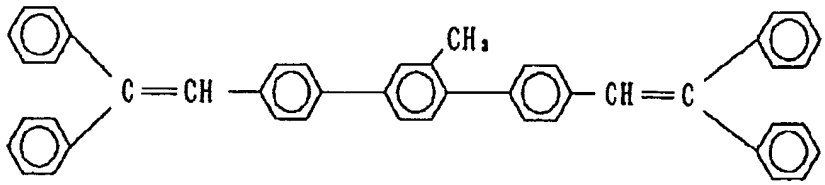
[0055]

[Formula 29]

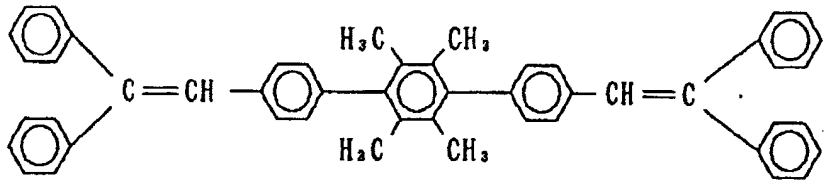
(1)



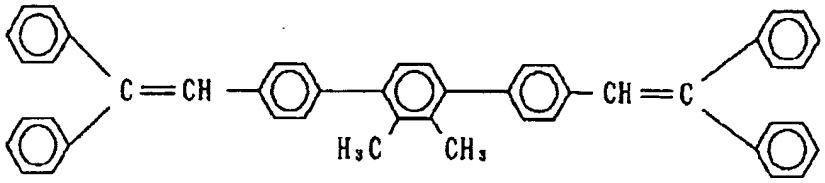
(2)



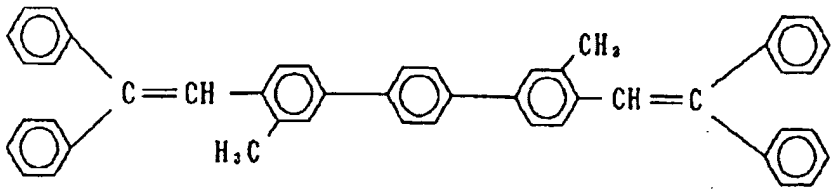
(3)



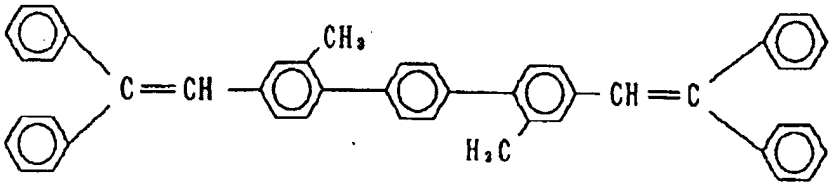
(4)



(5)



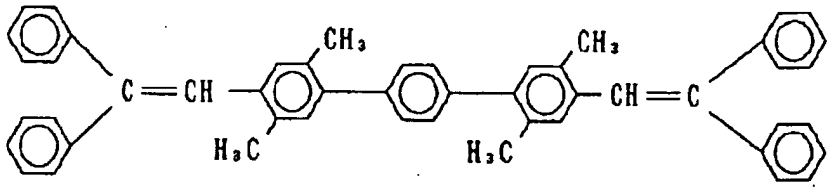
(6)



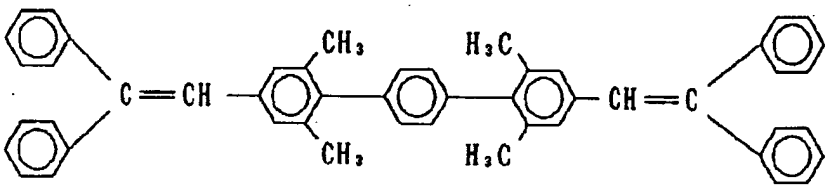
[0056]

[Formula 30]

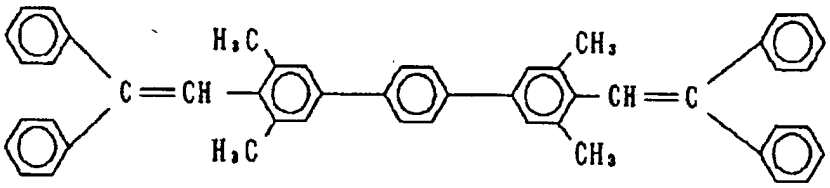
(7)



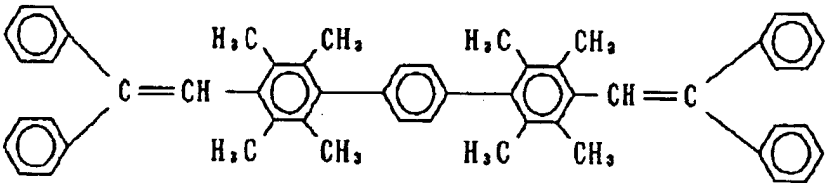
(8)



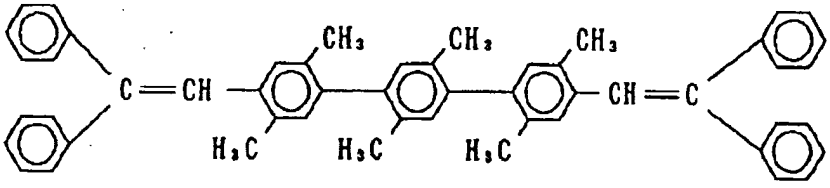
(9)



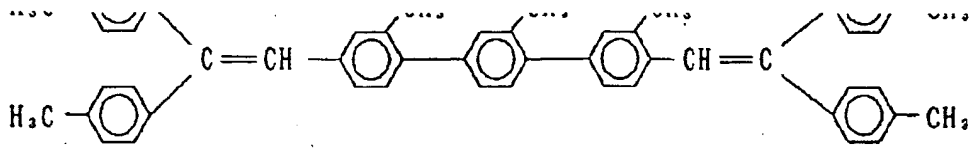
(1 0)



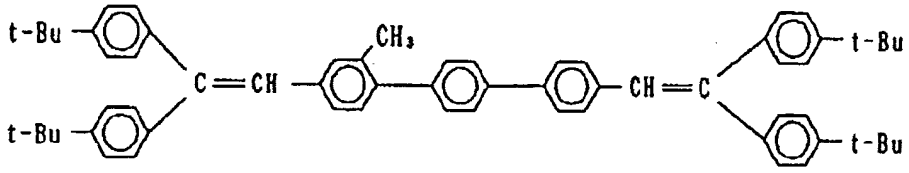
(1 1)



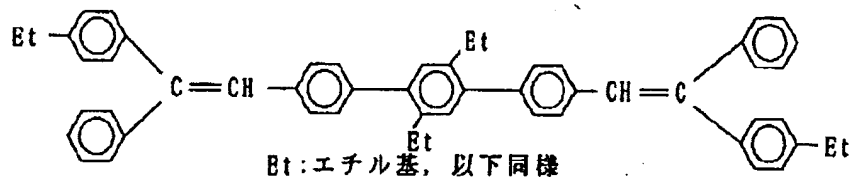
(1 2)



[0057]
[Formula 31]
(1 3)

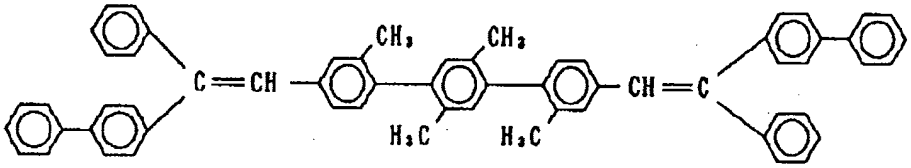


(1 4)

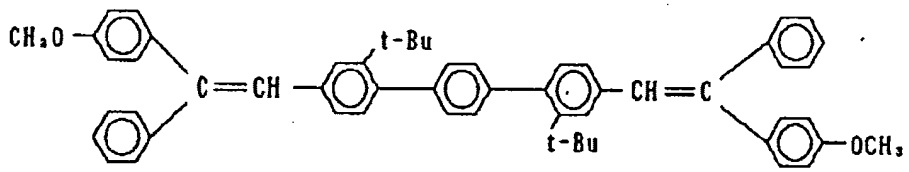


Et：エチル基，以下同様

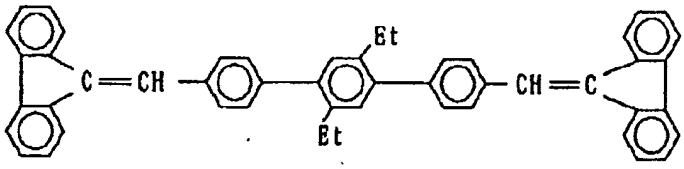
(1 5)



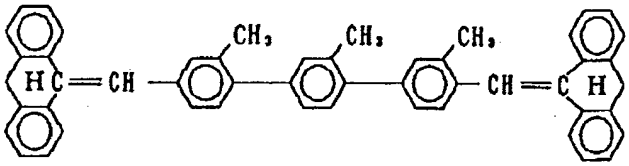
(1 6)



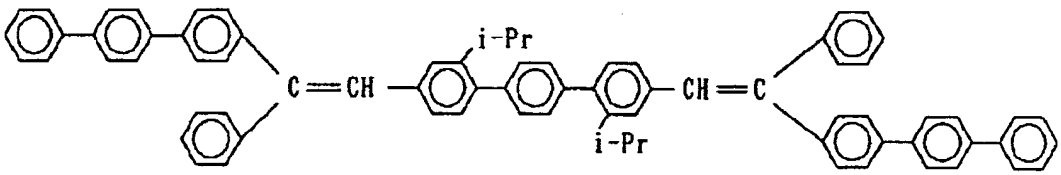
(1 7)



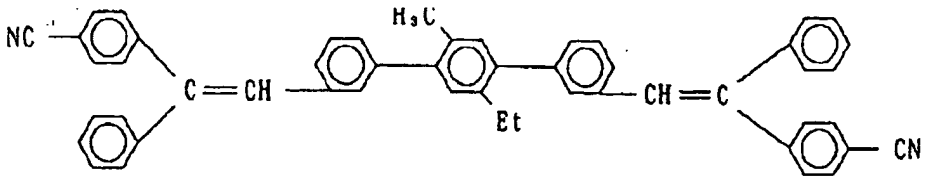
(1 8)



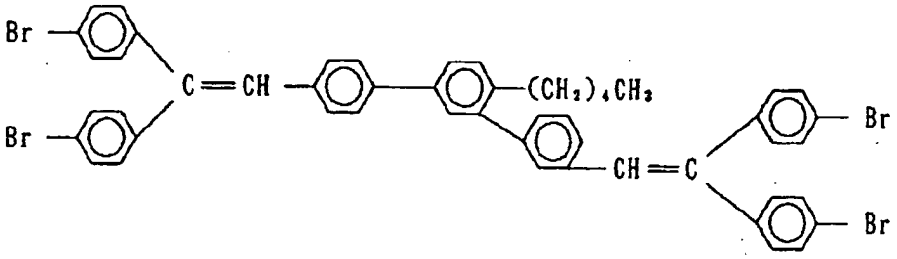
[0058]
[Formula 32]
(1 9)



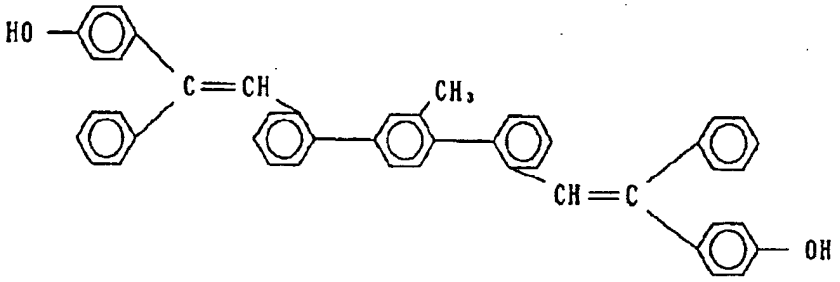
(2 0)



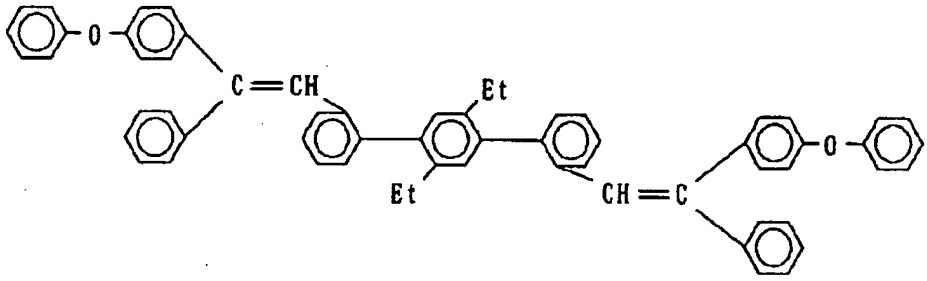
(21)



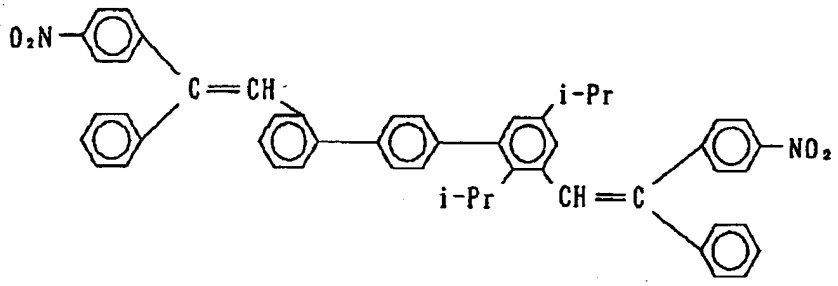
(22)



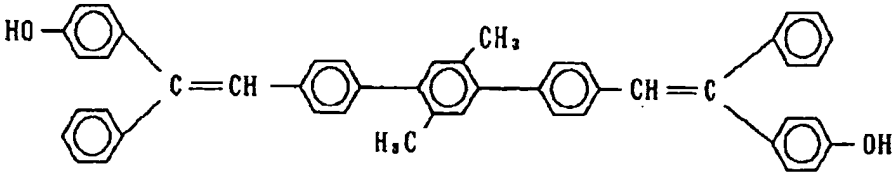
[0059]
[Formula 33]
(23)



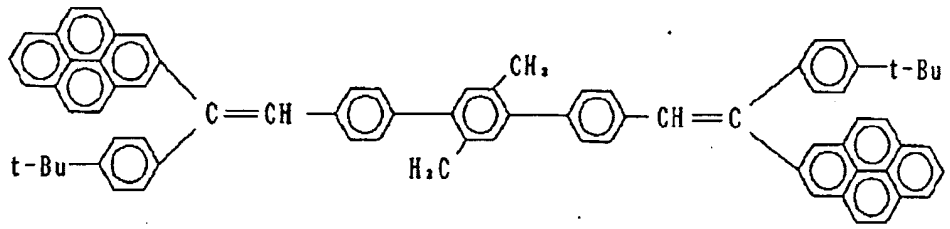
(24)



(25)

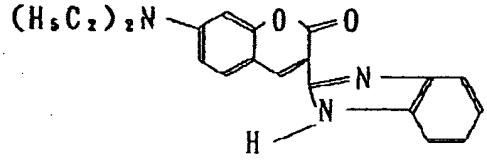


(26)

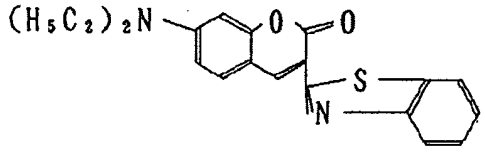


[0060] On the other hand, about the organic compound which is used for the second luminous layer and whose fluorescence peak wavelength of a solid state is 480nm or more less than 580nm, the coumarin derivative used as laser coloring matter which especially a limit does not have, for example, is indicated by the Europe public presentation patent No. 0281381 official report is mentioned. Specifically, it is [0061].

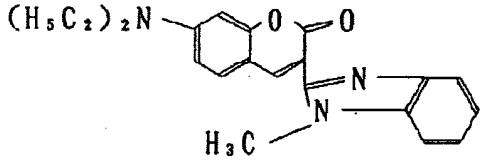
[Formula 34]



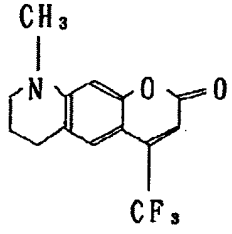
・・・クマリン7



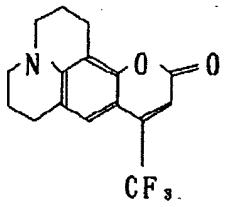
・・・クマリン6



・・・クマリン30



・・・クマリン522

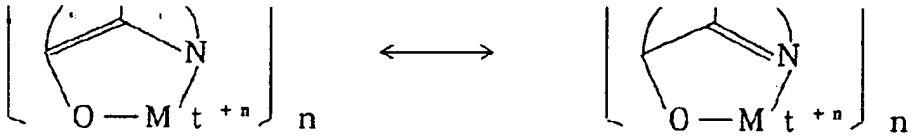


・・・クマリン153

[0062] It is ****. Furthermore, what satisfies the fluorescence conditions of the second luminous layer of the above in the organic compound indicated by JP,3-231970,A or the Japanese-Patent-Application-No. No. 279304 [two to] specification is mentioned. Furthermore, the metal complex of 8-hydroxyquinoline or its derivative can be mentioned as a desirable thing. Specifically, it is a metal chelate oxy-NOIDO compound containing the chelate of an oxine (generally an eight quinolinol or 8-hydroxyquinoline). Such a compound shows a high level performance and is easily fabricated by the thin film form. The example of an oxy-NOIDO compound fills the following structure expression.

[0063]

[Formula 35]



[0064] Mt expresses a metal among [formula, n is the integer of 1-3, and the atom which needs Z in order the position is independent in each and to complete at least two or more fused aromatic rings is shown.] Here, the metal expressed with Mt can be used as monovalent and a bivalent or trivalent metal, and are earth metals, such as alkaline earth metal, such as alkali metal, such as a lithium, sodium, or a potassium, magnesium, or calcium, boron, or aluminum. Each monovalent and the bivalent or trivalent metal which are known as it is generally a useful chelate compound can be used.

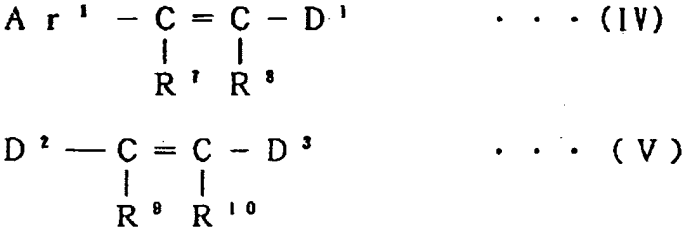
[0065] Moreover, Z shows the atom in which the heterocycle which one side of at least two or more fused aromatic rings becomes from an azole or an azine is made to form. Here, if required, it is possible to add the ring from which others differ to the above-mentioned fused aromatic ring. Moreover, in order to avoid adding a ******** molecule, with no improvement on a function, as for the number of the atoms shown by Z, maintaining or less to 18 is desirable.

[0066] Furthermore, if a chelation oxy-NOIDO compound is illustrated concretely Tris Aluminum, a screw (Eight quinolinol) Magnesium, a screw (Eight quinolinol) Zinc, a screw (Eight quinolinol) Zinc, a screw (2-methyl-eight quinolinol) Zinc, a screw (Benzo-8-quinolinol) (2-methyl-8-quinolilato)aluminumoxide, a tris (eight quinolinol) indium, tris (5-methyl-eight quinolinol) aluminum, an eight-quinolinol lithium, a tris (5-chloro-eight quinolinol) gallium, tris A gallium, a screw (2-methyl-eight quinolinol) Calcium, 5, 7-dichloro-eight-quinolinol aluminum, tris (5, 7-dibromo-8-hydroxy quinolinol) aluminum, tris (7-propyl-eight quinolinol) aluminum, a screw (5-chloro-eight quinolinol) (Eight quinolinol) There are beryllium, screw (2-methyl-eight quinolinol) beryllium, etc.

[0067] In the white organic EL element of this invention, it is desirable to make [as which it was chosen from the stilbene derivative indicated by the first luminous layer of the above and/or the second luminous layer at the Japanese-Patent-Application-No. No. 129438 / five to / specification, the JISUCHIRIRU arylene derivative, and the tris styryl arylene derivative] a kind contain at least. This stilbene derivative is a compound which has at least two aromatic rings, combines these aromatic rings by the vinyl group or the replaced vinyl group, and is constituted, and has an electron repelling group in either the above-mentioned aromatic ring or a vinyl group. A JISUCHIRIRU arylene derivative is a compound which two aromatic rings combine with one arylene machine through a vinyl group or a substitution vinyl group, and has an electron repelling group. A tris styryl arylene derivative is a compound which three aromatic rings combine with one trivalent aromatic ring machine through a vinyl group or a substitution vinyl group, and has an electron repelling group. In the aforementioned derivative which has an electron repelling group in a molecule skeleton, this electron repelling group shows the amino group which has the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, and the hydrocarbon group of carbon numbers 1-30 preferably. In the above-mentioned derivative, especially a desirable thing is a compound expressed with following general formula (IV) - (X), (IV) and (V) express a stilbene derivative, (VI), and (VII) a JISUCHIRIRU arylene derivative, and - (VIII) (X) expresses a tris styryl arylene derivative.

[0068]

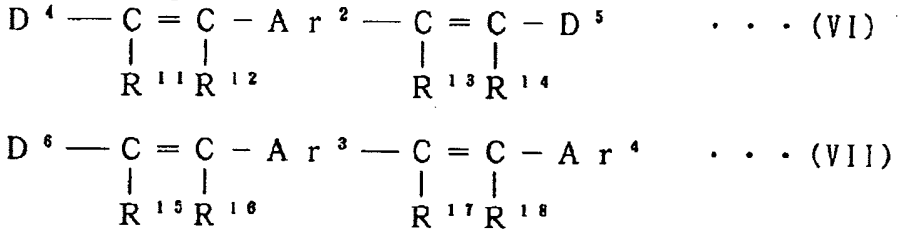
[Formula 36]



hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D1 -D3 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown. Here, Ar1 and R7 -R10 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, this substituent may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation.]

[0070]

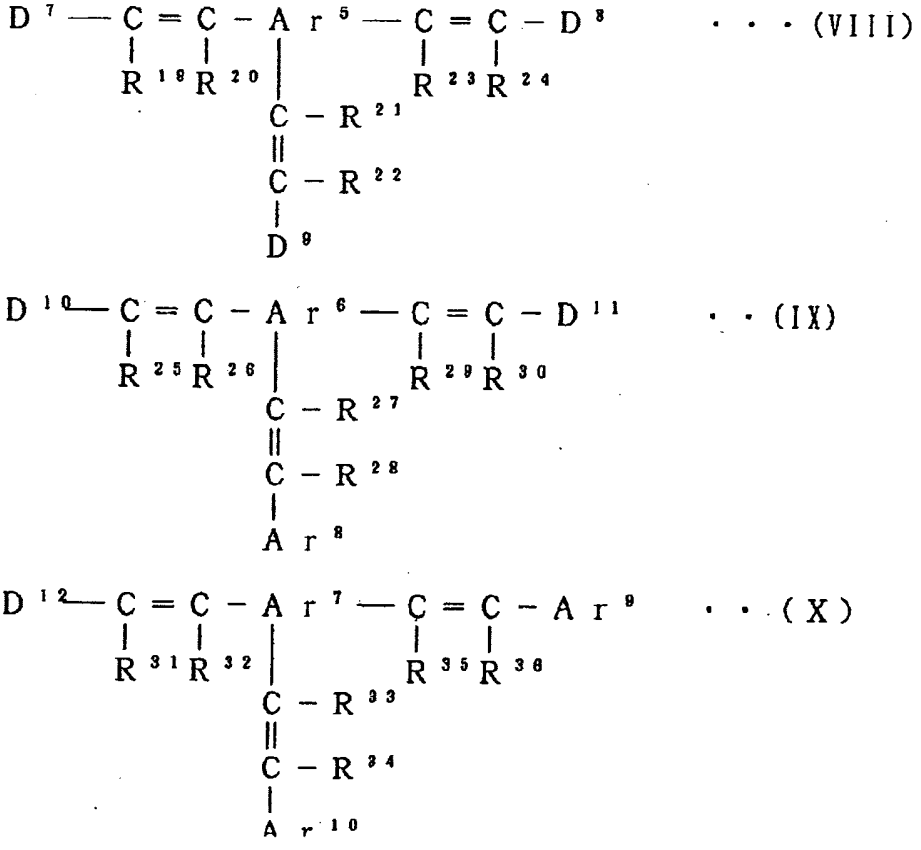
[Formula 37]



[0071] Among [formula, Ar2 and Ar3 show the arylene machine of carbon numbers 6-20 independently, respectively, and Ar4 shows the aryl group of carbon numbers 6-20. R11-R18 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. Here, Ar2 -Ar4, and R11-R18 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-10, the aralkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, these substituents may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation. D4 -D6 The aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively or the condensation polycyclic group machine of carbon numbers 10-30 is shown.]

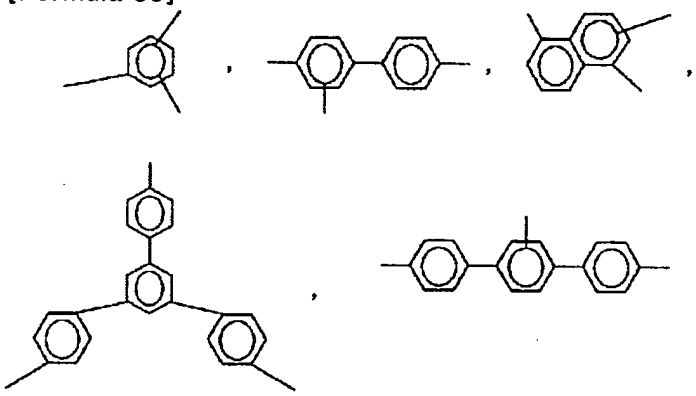
[0072]

[Formula 38]



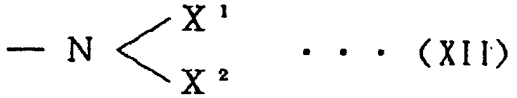
[0073] Among [formula, Ar5 -Ar7 shows the trivalent aromatic ring machine of carbon numbers 6-24 independently, respectively, and Ar8 -Ar10 shows the aryl group of carbon numbers 6-20 independently, respectively. R19-R36 show a hydrogen atom or the aryl group of carbon numbers 6-20 independently, respectively. D7 -D12 show the aryl group of the carbon numbers 6-20 independently replaced by the electron repelling group, respectively, or the condensation polycyclic group machine of carbon numbers 10-30. Here, Ar5 -Ar7, and R19-R36 could be replaced independently, respectively, and they may be replaced by the amino group which has the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, the aralkyl machine of carbon numbers 6-10, the arylated-alkyl machine of carbon numbers 6-10, or the hydrocarbon group of carbon numbers 1-20. Moreover, these substituents may join together mutually and may form the five membered ring or six membered ring of saturation or an unsaturation.] The above-mentioned general formula (IV) As an aryl group in - (X), a phenyl group, a biphenylyl machine, a naphthyl group, a pyrenyl machine, a TAFENIRUIRU machine, an anthranil, a tolyl group, a xylyl group, a stilbenyl machine, a thienyl group, a BICHIENIRU machine, a thiophene machine, a bithiophene machine, a TACHIOFEN machine, etc. are mentioned preferably. As an arylene machine, a phenylene group, a biphenylene machine, a naphthylene machine, an anthra NIREN machine, a terphenylene machine, a pyrenylene machine, a still BENIREN machine, a thienylene machine, a BICHIENIREN machine, etc. are mentioned preferably. A trivalent aromatic ring machine is [0074] preferably.

[Formula 39]



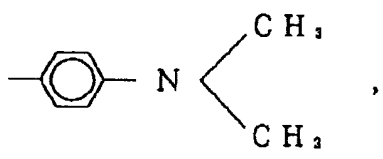
[0075] **********. Moreover, as an aryloxy group which is the above-mentioned substituent, a phenyloxy machine, a biphenyl oxy-basis, a naphthyloxy machine, an anthranil oxy-basis, a terphenyl oxy-basis, a pyrenyl oxy-basis, etc. are mentioned, and a methyl group, an ethyl group, an isopropyl machine, a TASHARU butyl, a pentyl machine, a hexyl machine, etc. are mentioned as an alkyl group. As an alkoxy group, a methoxy machine, an ethoxy basis, an isopropoxy group, a TASHARU butoxy machine, a pentyloxy machine, etc. are mentioned, and a dimethylamino machine, a diethylamino machine, a diphenylamino machine, a phenyl ethylamino machine, a phenyl methylamino machine, a ditolylamino machine, an ethyl phenylamino machine, the phenyl naphthyl amino group, the phenyl biphenyl amino group, etc. are mentioned as an amino group which has a hydrocarbon group. The aforementioned general formula (IV) D1 -D12 in - (X) are the aryl group of the carbon numbers 1-20 replaced by the electron repelling group, or the condensation polycyclic group machine of carbon numbers 10-30. Here, with an electron repelling group, the amino group which has the alkoxy group of carbon numbers 1-10, the aryloxy group of carbon numbers 6-20, and the hydrocarbon group of carbon numbers 1-30 preferably is mentioned, and the amino group which has the hydrocarbon group of carbon numbers 1-30 preferably especially is mentioned. As this amino group, it is a general formula (XII) [0076].

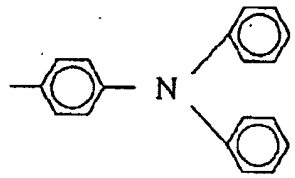
[Formula 40]

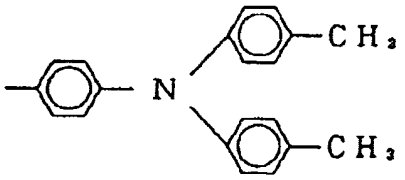


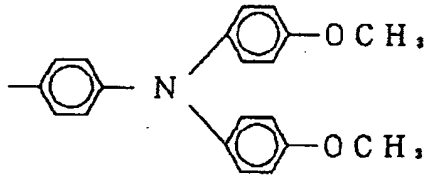
[0077] Among [formula, the aryl group of carbon numbers 6-20, the alkyl group of carbon numbers 1-10, or the aralkyl machine of carbon numbers 6-20 may be shown independently, respectively, it may join together mutually, and X1 and X2 may form the cyclic structure of saturation or an unsaturation. X1 and X2 **** -- the alkyl group of carbon numbers 1-10, the aralkyl machine of carbon numbers 7-10, the aryloxy group of carbon numbers 6-10, or the alkoxy group of carbon numbers 6-10 may replace [moreover,] Furthermore, X1 as an aryl group replaced by the amino group expressed with a general formula (XII) X2 You may become the nitrogen-containing aromatic ring machine united [each other].] It comes out and what is expressed is mentioned. As the above-mentioned electron repelling group, for example Aryloxy groups, such as a phenyloxy machine, a biphenyl oxy-basis, a naphthyloxy machine, an anthranil oxy-basis, and a terphenyl yloxy machine, Alkoxy groups, such as a methoxy machine, an ethoxy basis, an isopropoxy group, a TASHARU butyloxy machine, and a pentyloxy machine, A dimethylamino machine, a diethylamino machine, a diphenylamino machine, The amino group which has hydrocarbon groups, such as a phenyl methylamino machine, a phenyl ethylamino machine, a phenylmethyl ethylamino machine, a ditolylamino machine, an ethyl phenylamino machine, a phenyl naphthyl amino group, and a phenyl biphenyl ylamino machine, is mentioned. Moreover, as an example of D1 -D12, it is [0078].

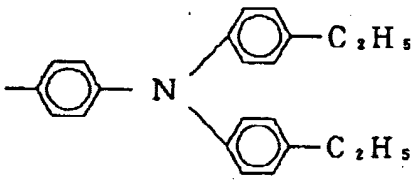
[Formula 41]

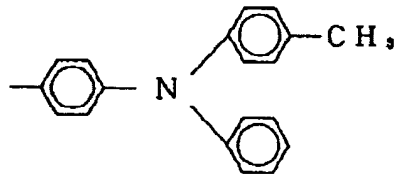


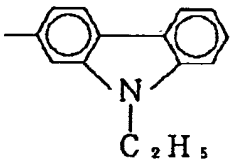


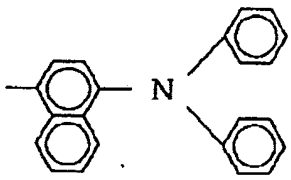


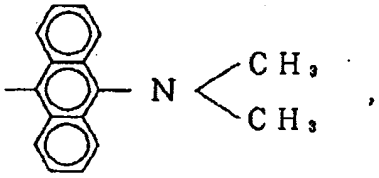






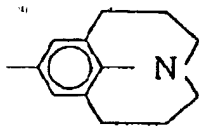
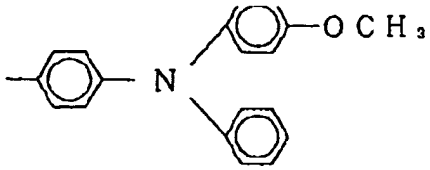
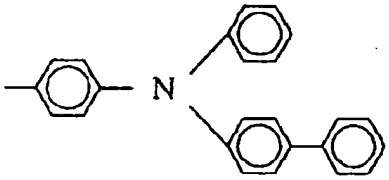
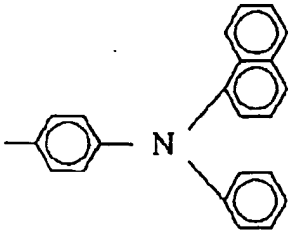
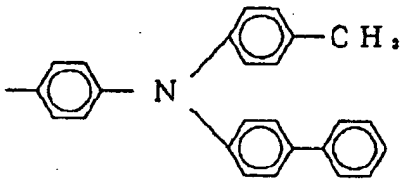
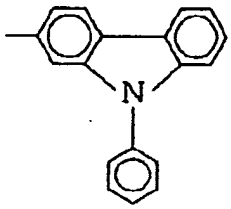
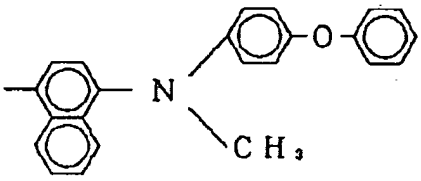
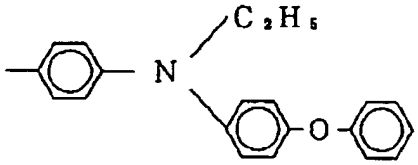
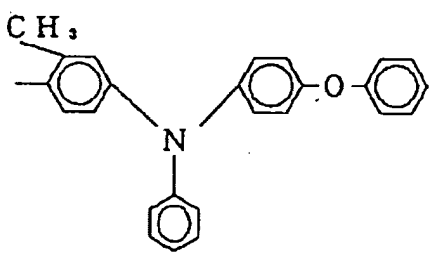
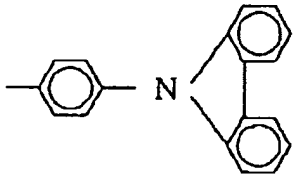
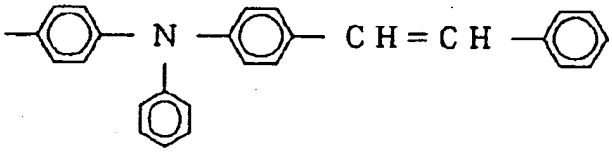




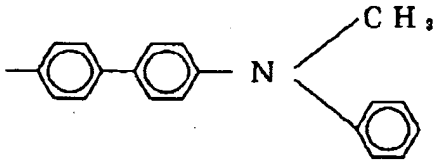
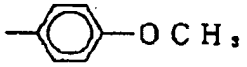
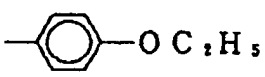
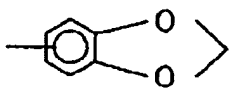
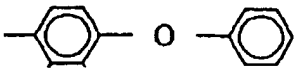


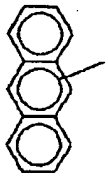
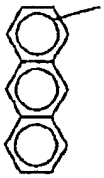
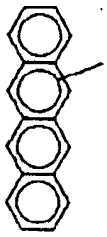
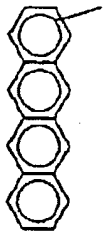
[0079]

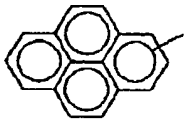
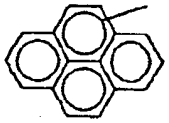
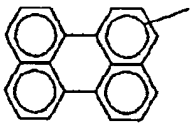
[Formula 42]

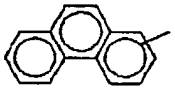
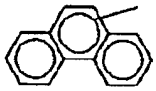
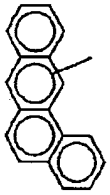
[0080]
[Formula 43]

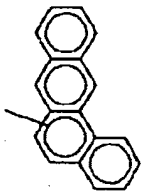
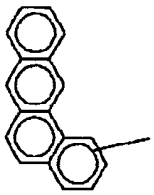
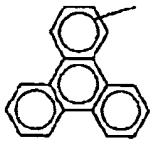






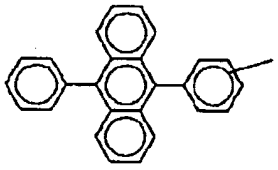
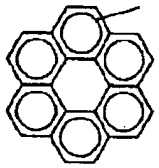





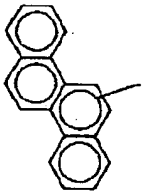
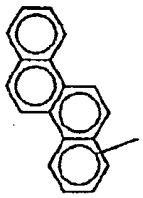




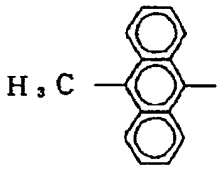
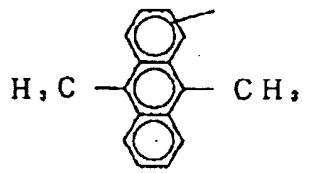
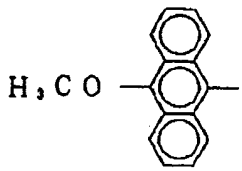
[0081]
[Formula 44]

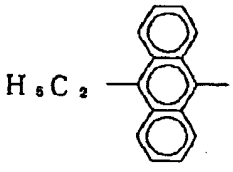
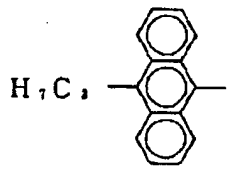




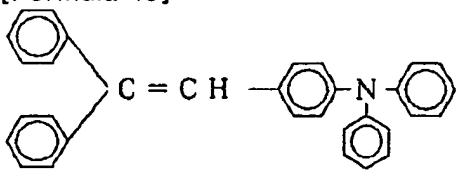



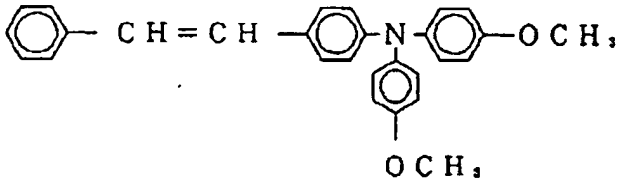




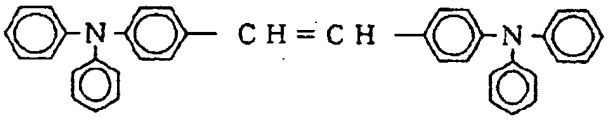



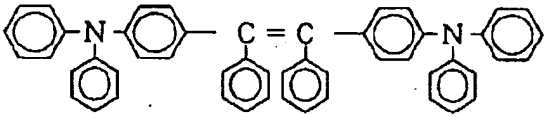
[0082] **** is mentioned. The above-mentioned general formula (IV) As an example of a compound expressed with - (X), it is [0083].

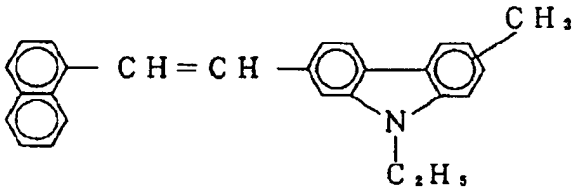
[Formula 45]

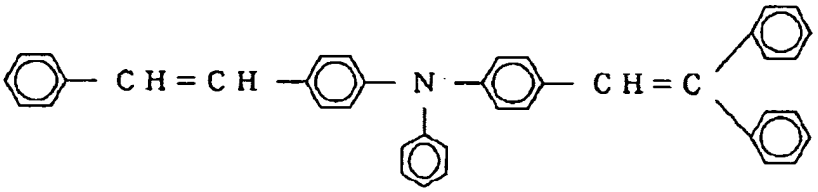


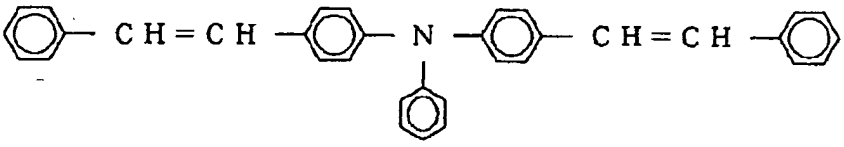






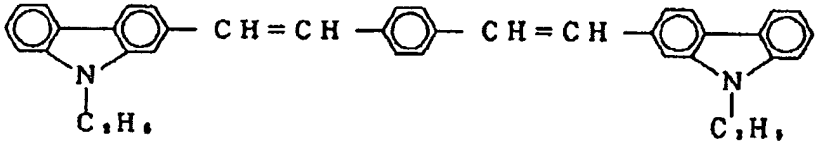


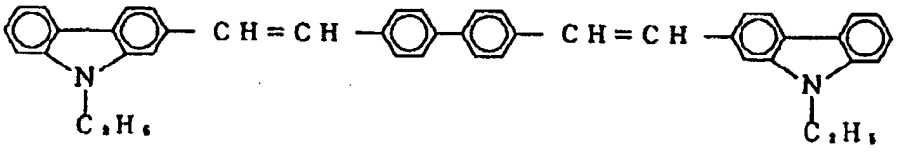


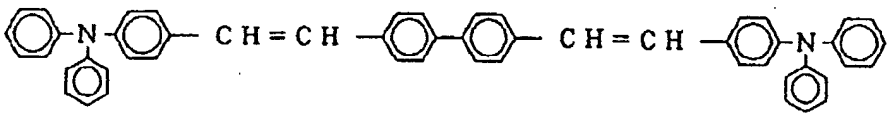


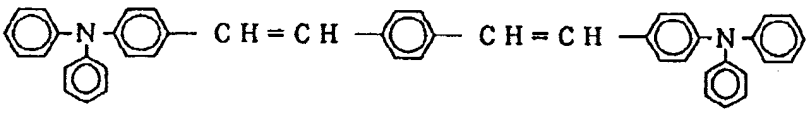
[0084]

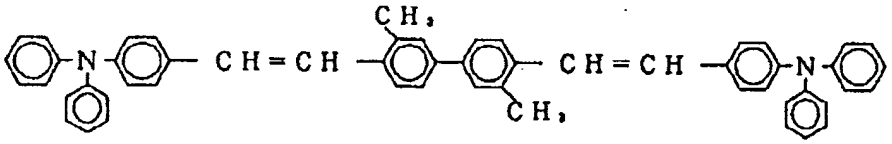
[Formula 46]

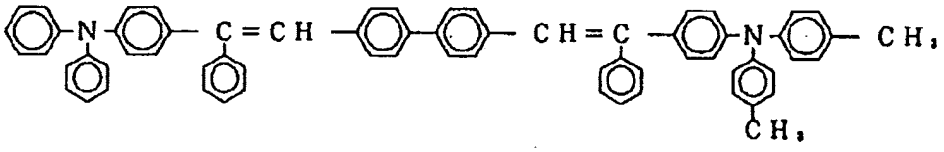


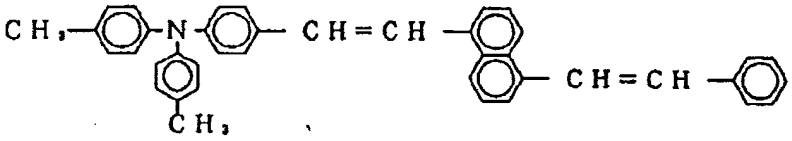




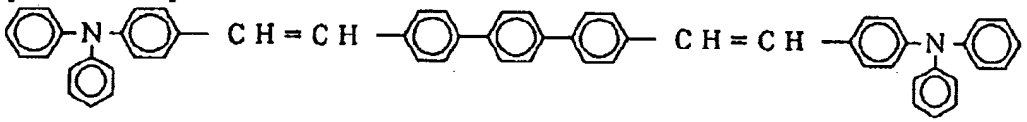


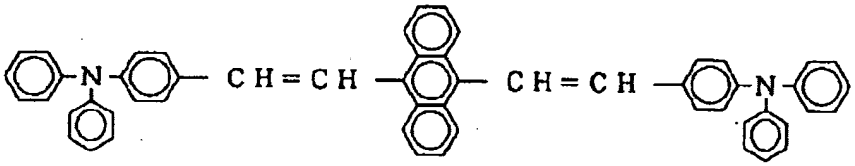


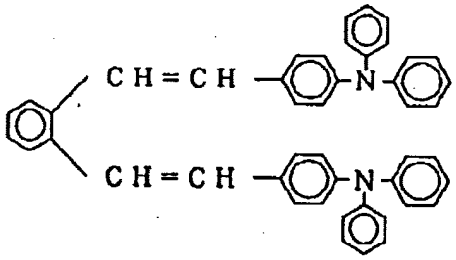


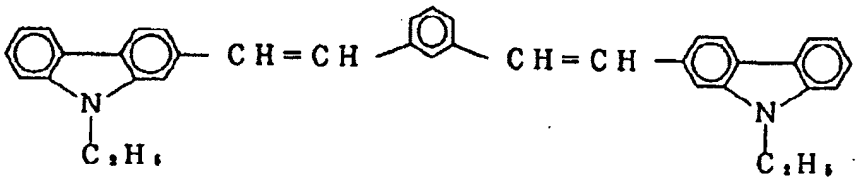


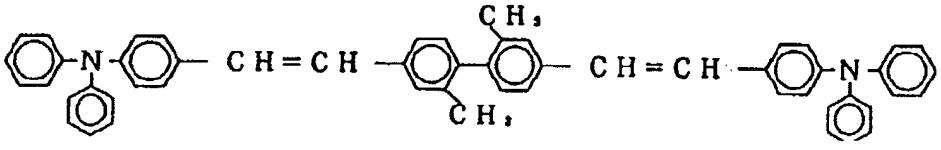
[0085]
[Formula 47]

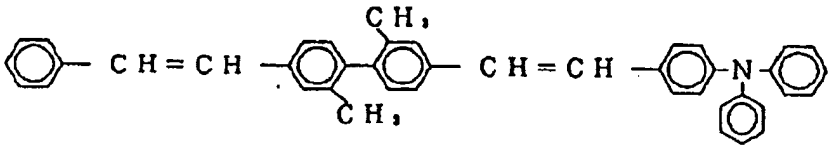




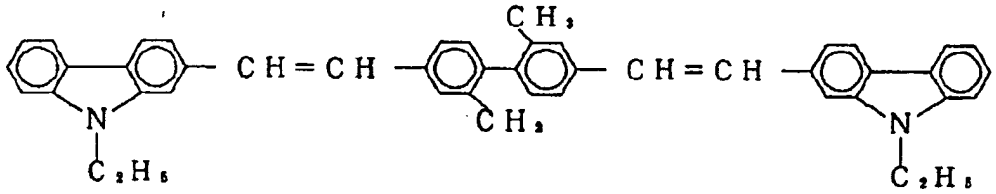


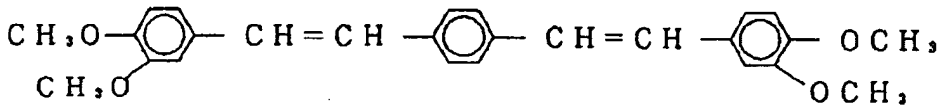


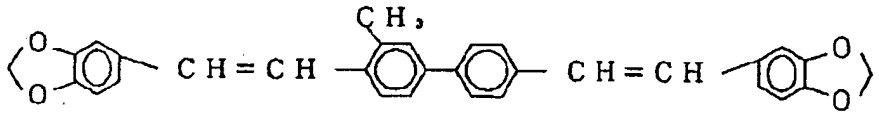


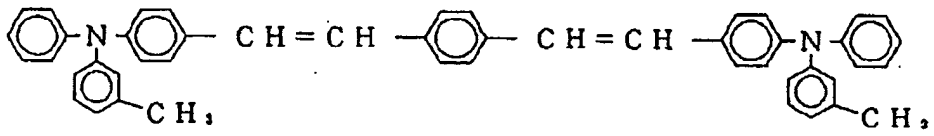


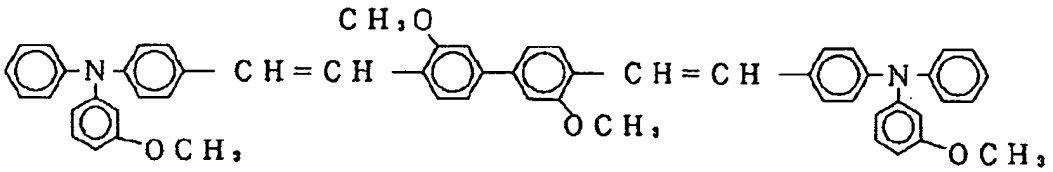
[0086]
[Formula 48]

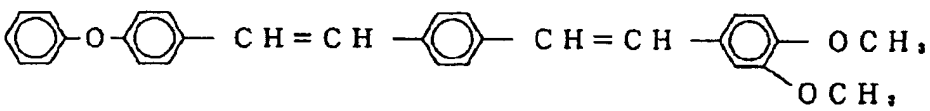


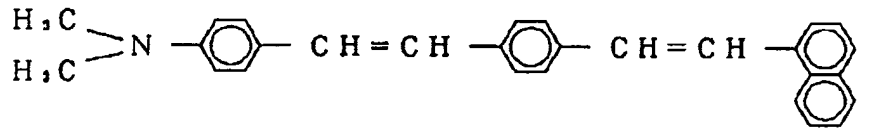




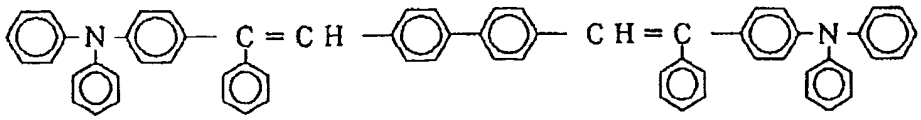


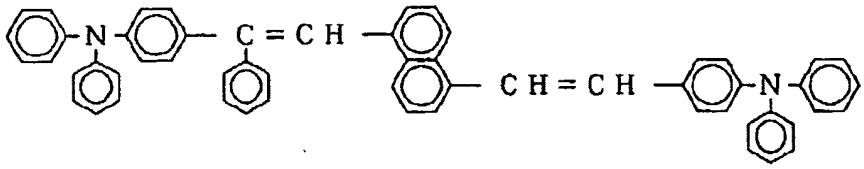


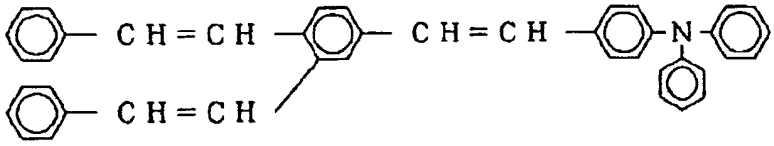


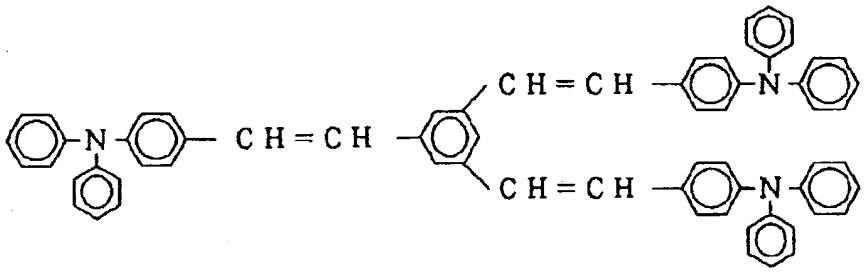


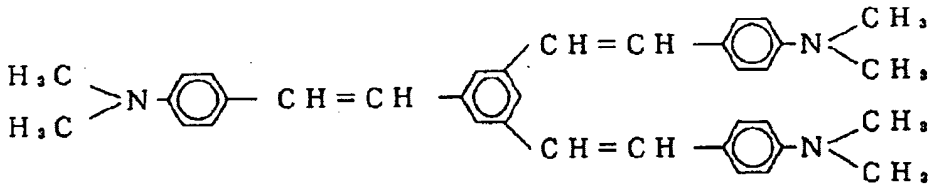
[0087]



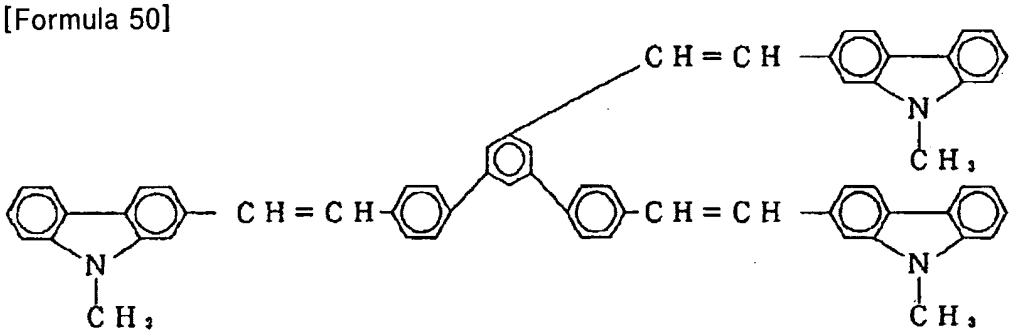


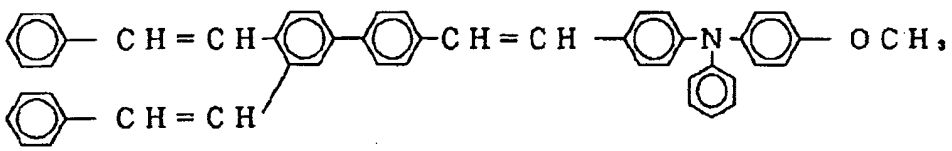


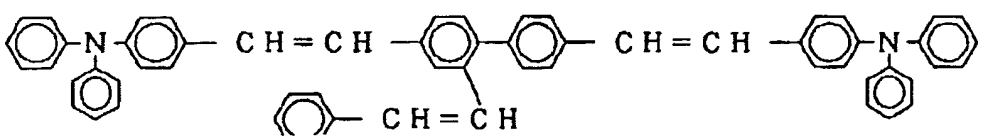




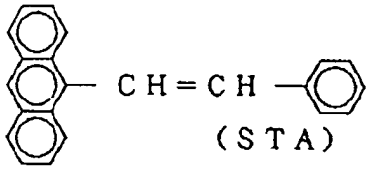
[0088]
[Formula 50]



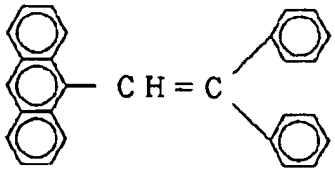


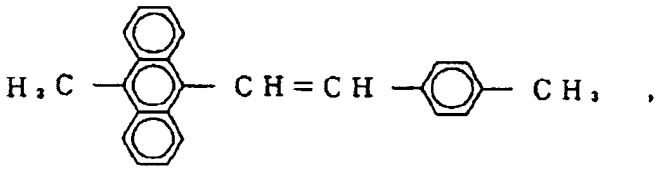


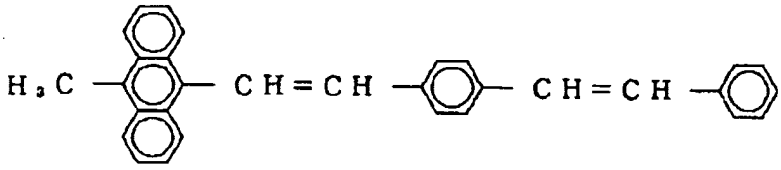
[0089]
[Formula 51]

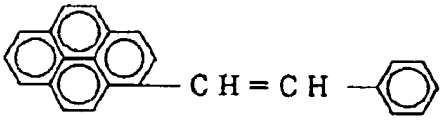


(STA)

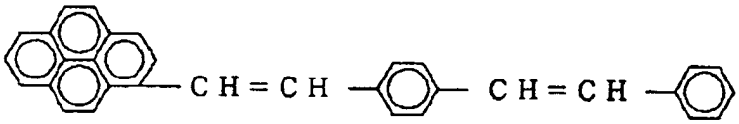




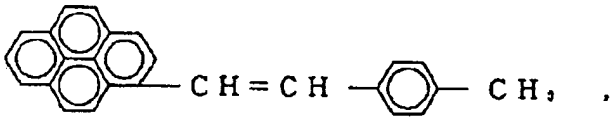




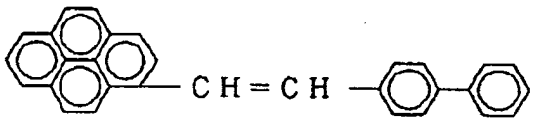
(STPy)



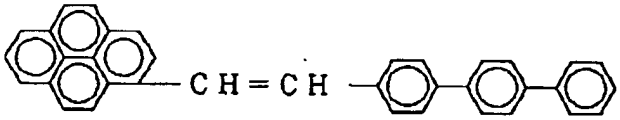
(STSTPy)

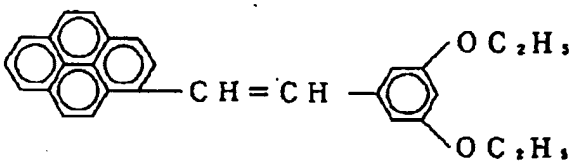


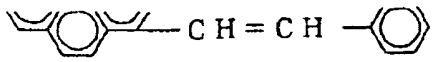
(MeSTPy)

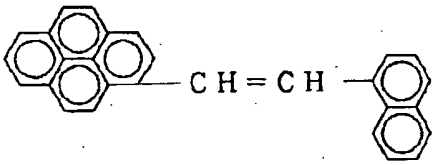


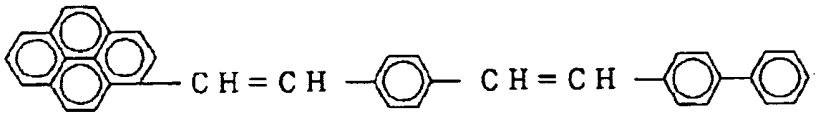
[0090]
[Formula 52]

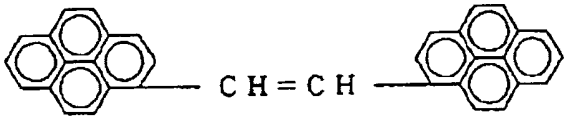


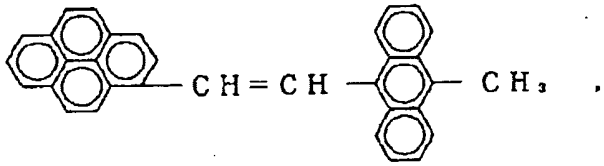




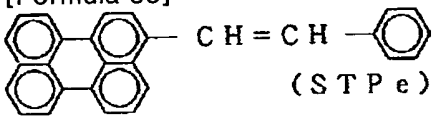


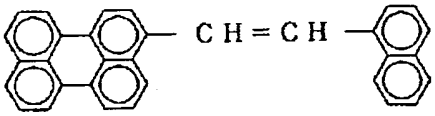


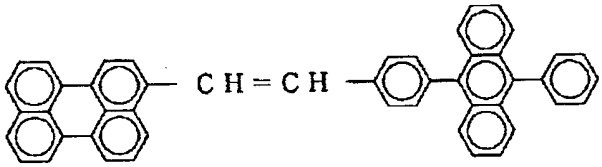


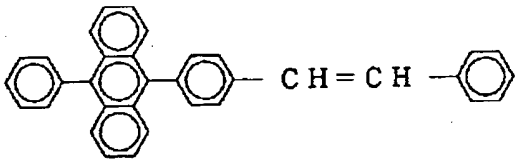


[0091]
[Formula 53]





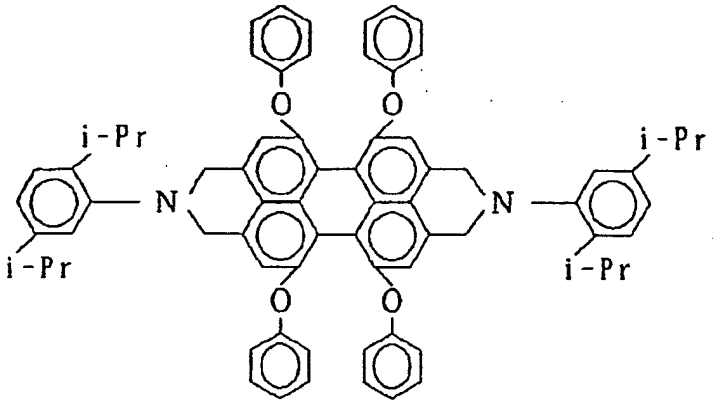




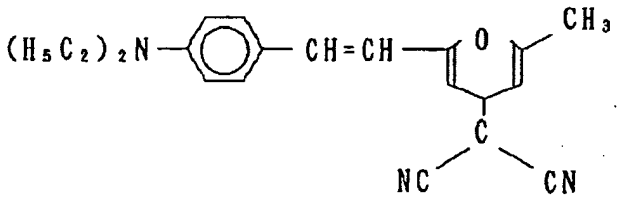
[0092] **** can be mentioned.
[0093] In the white organic EL element of this invention, the thing as which the fluorescence peak wavelength in a solution state was chosen from the first luminous layer of the above, the second luminous layer, and other organic compound layers in 580nm or more organic compound it is [organic compound] 650nm or less and which is made for a monostromatic to contain at least is required. As this organic compound, that the peak wavelength in a solution state should just be 580nm or more 650nm or less, although there is especially no limit, the

dicyanomethylene pyran derivative used as red start laser coloring matter indicated by the Europe public presentation patent No. 0281381 official report, for example, a dicyanomethylene thiopyran derivative, a fluorescein derivative, a perylene derivative, etc. are mentioned. Specifically, it is [0094].

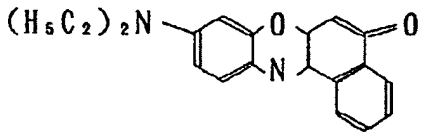
[Formula 54]



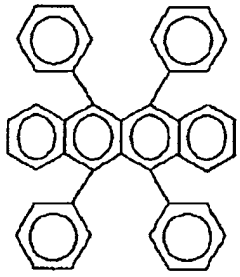
（ルモゲンＦレッド）



（ジシアノメチレンピラン）



（フェノキサゾン）



（ルブレン）

[0095] **** is mentioned. It is required that these organic compounds make it contain at 0.5-5-mol % of a rate preferably to the organic compound which forms a layer 0.1-10-mol%. These 0.1 - 10% is a density range for not producing concentration quenching.

[0096] Except the composition of a luminous layer, the composition of the white organic EL

Concretely, each composition of an organic EL element which consists of an anode plate / hole-injection transporting bed / luminous layer / an electron-injection transporting bed / cathode is explained.

[0097] As for the white organic EL element of this invention, forming on a support substrate is desirable. As for the support substrate used, what has transparency is desirable, and, generally they are glass, transparent plastics, a quartz, etc. What makes electrode material the large (4eV or more) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as an anode plate in the white organic EL element of this invention is used preferably. As an example of such electrode material, a transparent material or translucent material with the dielectric, such as metals, such as Au, CuI, ITO and SnO2, and ZnO, are mentioned. This anode plate can produce these pole matter by making a thin film form by methods, such as vacuum evaporationo and sputtering. When taking out luminescence from this electrode, it is desirable to make permeability larger than 10%, and below hundreds ofohms / ** of the sheet resistance as an electrode are desirable. Although thickness is furthermore based also on material, 10nm - 1 micrometer is usually preferably chosen in 10-200nm.

[0098] What, on the other hand, makes electrode material the small (4eV or less) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as cathode is used. As an example of such electrode material, a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium / copper mixture, aluminum/(aluminum 2O3), an indium, the rare earth metal, etc. are mentioned. This cathode can produce such electrode material by making a thin film form by methods, such as vacuum evaporationo and sputtering. Moreover, below hundreds ofohms / ** of the sheet resistance as an electrode are desirable, and 10nm - 1 micrometer of thickness is usually preferably chosen in 50-200nm. In addition, in this EL element, in order that it may penetrate luminescence that either this anode plate or cathode is transparent or translucent, the drawing efficiency of luminescence is well convenient.

[0099] The luminous layer in this EL element has the laminated structure by which consisted of the first luminous layer of the above, and the second luminous layer, and the laminating was carried out one by one to the order of the first luminous layer and the second luminous layer from the transparent-electrode or anode plate side. It is more desirable than a luminous layer with the far luminous layer especially near a cathode side that electronic transport capacity is size. Main luminescence arises in two luminous layer interfaces, the energy of luminescence here or an excitation state is used, the organic compound whose fluorescence peak in a liquid state is 580nm or more 650nm or less emits light, and this makes white luminescence take out from a transparent electrode. When the order of a laminating of the first luminous layer and the second luminous layer becomes reverse, luminescence of the first luminous layer is absorbed by the second luminous layer, and good white is no longer obtained. Since the fluorescence peak in a liquid state is a long wavelength component, 580nm or more organic compound it is [organic compound] 650nm or less is not absorbed by other components, and it may make what layer of an organic compound layer contain it on luminescence wavelength. And the second luminous layer can choose [preferably] the thickness of a luminous layer according to a situation suitably in this range that what is necessary is just more than the thickness of the first luminous layer. Although the formation method of the above-mentioned luminous layer can be formed by not being limited, for example, thin-film-izing by well-known methods, such as a vacuum deposition, the spin coat method, the cast method, and the LB method, it is desirable that it is especially a molecule deposition film. Here, molecule deposition films are the thin film which self-possessed was carried out and was formed from the gaseous-phase state of this compound, and a film which the solid state was carried out and was formed from the solution state or liquid phase state of this compound, and this molecule deposition film can usually be classified by the difference of condensation structure and higher order structure, and the functional difference resulting from it with the thin film (molecule built up film) formed by the LB method.

[0100] Thus, the luminous layer in this invention offers the place of the reunion of the transportation function, electron, and electron hole to which the charge (an electron and

electron hole) which can pour in an electron hole from an anode plate or a hole-injection transporting bed at the time of electric-field impression, and can pour an electron into it from cathode or an electron-injection transporting bed, and which pouring-functioned and was poured in is moved by the force of electric field, and has the luminescence function to tie this to luminescence etc. The luminous layer of this invention is a layer which emits light in the light. In addition, an electron hole is poured in, an electron is poured in with easy, and there may be a difference in easy. Moreover, it is desirable to move either although size may be in the transportation function in which it is expressed with an electron hole and the degree of electron transfer. Furthermore, the luminescent material used by this invention may emit light in response to supply of the excitation state by the charge recombined in other organic compound layers. Next, it is more desirable to use for improvement in luminescent ability, although the hole-injection transporting bed in the EL element of this invention was not necessarily required for this element. As this hole-injection transporting bed, the material which conveys an electron hole to a luminous layer by low electric field more is desirable, and the mobility of an electron hole is 104-106 further. If it is 10-6cm2 / bolt, and a second at least in the electric field of a bolt/cm, in addition, it is desirable. For example, in ****** material, arbitrary things can be conventionally chosen and used out of what is commonly used as a charge pouring transportation material of an electron hole, or the well-known thing used for the hole-injection transporting bed of an EL element.

[0101] As a hole-injection transporting bed, for example A triazole derivative (references, such as a U.S. Pat. No. 3,112,197 specification), An OKISA diazole derivative (references, such as the 3,189,447th number specification of the U.S. patent), An imidazole derivative (references, such as JP,37-16096,B), the poly aryl alkane derivative (the [U.S. patent] -- 3,615,402) a number specification -- this 3,820,989 a number specification -- this 3,542,544 References, such as a number specification, JP,45-555,B, a 51-10983 official report, JP,51-93224,A, a 55-17105 official report, a 56-4148 official report, a 55-108667 official report, a 55-156953 official report, and a 56-36656 official report, A pyrazoline derivative and a pyrazolone derivative (the [U.S. patent] -- 3,180,729) a number specification -- this 4,278,746 A number specification, JP,55-88064,A, a 55-88065 official report, a 49-105537 official report, a 55-51086 official report, a 56-80051 official report, a 56-88141 official report, a 57-45545 official report, a 54-112637 official report, References, such as a 55-74546 official report, A phenylenediamine derivative (references, such as the 3,615,404th number specification of the U.S. patent, JP,51-10105,B, a 46-3712 official report, a 47-25336 official report, JP,54-53435,A, a 54-110536 official report, and a 54-119925 official report), an arylamine derivative (the [U.S. patent] -- 3,567,450) a number specification -- this 3,180,703 a number specification -- this 3,240,597 a number specification -- this 3,658,520 a number specification -- this 4,232,103 a number specification -- this 4,175,961 a number specification -- said -- 4,012,376 A number specification, JP,49-35702,B, a 39-27577 official report, JP,55-144250,A, a 56-119132 official report, a 56-22437 official report, and West German patent 1,110,518th References, such as a number specification An amino substitution chalcone derivative (references, such as a U.S. Pat. No. 3,526,501 specification), An oxazole derivative (thing given in the 3,257,203rd number specification of the U.S. patent etc.), A styryl anthracene derivative (references, such as JP,56-46234,A), full -- me -- non -- a derivative (references, such as JP,54-110837,A) -- a hydrazone derivative (the [U.S. patent] -- 3,717,462) References, such as a number specification, JP,54-59143,A, a 55-52063 official report, a 55-52064 official report, a 55-46760 official report, a 55-85495 official report, a 57-11350 official report, a 57-148749 official report, and JP,2-311591,A, A stilbene derivative JP,61-210363,A, a 61-228451 official report, a 61-14642 official report, a 61-72255 official report, a 62-47646 official report, a 62-36674 official report, a 62-10652 official report, and a 62-30255 official report -- References, such as a 60-93445 official report, a 60-94462 official report, a 60-174749 official report, and a 60-175052 official report, etc. can be mentioned. Furthermore, a silazane derivative (U.S. Pat. No. 4950950 specification), a polysilane system (JP,2-204996,A), an aniline system copolymer (JP,2-282263,A) and the conductive polymer oligomer shown on the Japanese-Patent-Application-No. No. 211399 [one to] specifications,

[0102] In this invention, although these compounds can be used as a material of a hole-injection transporting bed The porphyrin compound shown below (Thing given in JP,63-2956965,A etc.) And an aromatic tertiary-amine compound and a styryl amine compound (the [U.S. patent] -- 4,127,412) A number specification, JP,53-27033,A, a 54-58445 official report, a 54-149634 official report, a 54-64299 official report, a 55-79450 official report, a 55-144250 official report, a 56-119132 official report, a 61-295558 official report, It is desirable references, such as a 61-98353 official report and a 63-295695 official report, and to use this aromatic tertiary-amine compound especially.

[0103] As an example of representation of this porphyrin compound Porphin; 1, 10, 15, 20-tetrapod phenyl-21H, 23H-porphin copper (II);1, 10 and 15, 20-tetrapod phenyl 21H, 23H-porphin zinc (II);5, 10 and 15, 20-tetrakis (pentafluorophenyl)-21H, and 23H-porphin; Silicon phthalocyanine oxide; Aluminum phthalocyanine chloride; A phthalocyanine ; (Non-metal) Dilithium phthalocyanine; copper tetramethyl phthalocyanine; -- copper-phthalocyanine; -- chromium phthalocyanine; -- zinc phthalocyanine; -- lead phthalocyanine; -- titanium phthalocyanine oxide; -- magnesium phthalocyanine; -- a copper octamethyl phthalocyanine etc. is mentioned moreover, as an example of representation of this aromatic tertiary-amine compound and a styryl amine compound N, N, N', and N' - tetrapod phenyl -4 and 4' - diamino phenyl;N and N' - diphenyl-N and N' - JI (3-methylphenyl) -4 and 4' - diamino biphenyl (TPDA);2 and 2-screw (4-G p-tolylamino phenyl) propane;1 -- 1-screw (4-G p-tolylamino phenyl) cyclohexane; -- N, N, N', and N' -- the - tetrapod-p-tolyl -4 and 4'-diamino biphenyl;1 -- a 1-screw (4-G p-tolylamino phenyl)-4-phenylcyclohexane; screw Phenylmethane; (4-dimethylamino-2-methylphenyl) A screw (4-G p-tolylamino phenyl) phenylmethane;N and N' - diphenyl-N and N' - JI (4-methoxypheny) -4 and 4' - diamino biphenyl; -- N, N, N', and N' - tetrapod phenyl -4, 4'-diamino diphenyl-ether;4, and 4' - screw KUODORI phenyl; N, N, and N-TORI (Diphenylamino) Amine; 4- (p-tolyl) (G p-tolylamino)-4'-[4 Styryl] stilbene; (G p-tolylamino) 4-N, N-diphenylamino-(2-diphenyl vinyl) benzene;3-methoxy-4'-N, and N-diphenylamino still benzene;N-phenyl carbazole; an aromatic JIMECHIRI DIN system compound etc. is mentioned. Moreover, the aromatic methylidyne compound (refer to a Japanese-Patent-Application-No. No. 279304 [two to] specification and JP,3-231970,A) shown as a material of a luminous layer can also be used as a material of a hole-injection transporting bed. Furthermore, p type-Si, p type - Inorganic compounds (refer to international public presentation patent WO No. 05998 [90 to] official report), such as SiC, can also be used as a material of a hole-injection transporting bed.

[0104] The hole-injection transporting bed in the EL element of this invention can be produced by the thin film-ized method a vacuum deposition method, the spin coat method, the cast method, the LB method, etc. are well-known, and can form the above-mentioned compound. Although there is especially no limit, 1nm - 10 micrometers of thickness as this hole-injection transporting bed are usually 5nm - 5 micrometers preferably. This hole-injection transporting bed may consist of monostromatics which consist of these hole-injection transportation material kinds or two sorts or more, or may carry out the laminating of the hole-injection transporting bed which consists of a compound of another kind to the aforementioned hole-injection transporting bed.

[0105] In the white organic EL element of this invention, in order to raise the adhesion between a luminous layer and cathode, as for this electron-injection transporting bed, it is desirable to contain an adhesive high material to a luminous layer and cathode. as such an adhesive high material -- nitration full -- me -- non, heterocycle tetracarboxylic acid anhydrides, such as a derivative, an anthra quinodimethan derivative, a diphenyl quinone derivative, a thiopyran dioxide derivative, and a naphthalene perylene derivative, a carbodiimide, a full ORENIRIDEN methane derivative, an anthra quinodimethan derivative and an anthrone derivative, an OKISA diazole derivative, other specific electron-transport nature compounds, etc. can be mentioned Moreover, the metal complex (aluminum, Zn, Li, Ga, Be, In, Mg, Cu, calcium, Sn, or Pb) of 8-hydroxyquinoline or its derivative can be mentioned. Specifically, it is a metal chelate oxy-NOIDO compound containing the chelate of an oxine

performance and is easily fabricated by the thin film gestalt.
[0106] Furthermore, if a chelation oxy-NOIDO compound is illustrated concretely Tris Aluminum; A screw (Eight quinolinol) Magnesium; A screw (Eight quinolinol) Zinc; A screw (Benzo-8-quinolinol) (2-methyl-8-quinolilato)aluminumoxide; -- tris (eight quinolinol) indium; -- tris (5-methyl-eight quinolinol) aluminum; -- eight-quinolinol lithium; -- tris (5-chloro-eight quinolinol) gallium; -- a screw Calcium; (5-chloro-eight quinolinol) There is 5 and 7-dichloro-eight-quinolinol aluminum; tris (5, 7-dibromo-8-hydroxy quinolinol) aluminum etc. In addition, that by which a metal free-lancer or metal phthalocyanines, and those ends are replaced with the alkyl group or the sulfone machine is also desirable. Furthermore, the JISUCHIRIRU pyrazine derivative mentioned above as a material of a luminous layer can also be used as a material of an electron-injection transporting bed. Furthermore, p type-Si, p type - Inorganic compounds (refer to international public presentation patent WO No. 05998 [90 to] official report), such as SiC, can also be used as a material of an electron-injection transporting bed.
[0107] The electron-injection transporting bed in the EL element of this invention can be produced by the thin film-ized method a vacuum deposition method, the spin coat method, the cast method, the LB method, etc. are well-known, and can form the above-mentioned compound. Although there is especially no limit, 1nm - 10 micrometers of thickness as this electron-injection transporting bed are usually 5nm - 5 micrometers preferably. This electron-injection transporting bed may consist of monostromatics which consist of these electron-injection transportation material kinds or two sorts or more, or may carry out the laminating of the electron-injection transporting bed which consists of a compound of another kind to the aforementioned electron-injection transporting bed.

[Translation done.]

EXAMPLE

[Example] Next, although an example explains this invention in more detail, this invention is not limited at all by these examples.
What manufactured ITO by 100nm thickness in the vacuum deposition on the example 1-325mmx75mmx1.1mm glass substrate was used as the transparent-electrode substrate. In isopropyl alcohol, ultrasonic cleaning was performed for 10 minutes and this substrate was immersed. This substrate was dried in dryness nitrogen, and subsequently, SAMUKO International Lab equipment (UV-300) performed UV ozone washing, and it considered as the transparent-electrode substrate. This transparent-electrode substrate is installed in the substrate electrode holder of commercial vacuum evaporationo equipment (product made from Japanese Vacuum technology). They are N and N'-diphenyl to the resistance heating boat made from molybdenum. - N, N'-screw (3-methylphenyl)-[1 and 1'-biphenyl]-4, and 200mg (TPD) of 4'-diamines are put in. Furthermore, 200mg (DPVBi) of 4 and 4'-screw (2 and 2'-diphenyl vinyl) biphenyls is put into another resistance heating boat made from molybdenum, the compound (A) shown in the 1st table is put into still more nearly another resistance heating boat made from molybdenum, and it is up to 1x10 to 4 Pa about a vacuum tub. It decompressed. Then, the boat containing TPD was heated to 215-220 degrees C, the vacuum evaporationo of the TPD was carried out on the transparent support substrate by the 0.1-0.3nm [/second] evaporation rate, and the hole-injection transporting bed of 60nm of thickness was produced. The substrate temperature at this time was a room temperature.
[0109] Next, without taking this out, the boat by which DPVBi entered on this hole-injection transporting bed was heated, and 40nm laminating deposition was carried out as the first luminous layer. The boat of a compound (A) was heated simultaneously and the first luminous layer was made to contain at a rate of (b) mol % which shows a compound (A) in the 1st table at this time. Then, the vacuum tub was returned to atmospheric pressure, 200mg (Alq) of 8-hydroxyquinoline aluminum complexes was newly put into the resistance heating boat made from molybdenum, the compound (C) shown in the 1st table was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was again decompressed up to 1x10 to 4 Pa. Subsequently, the boat containing Alq was heated and 20nm produced the film as the second luminous layer. The boat of a compound (C) was also heated simultaneously and the second luminous layer was made to contain at a rate of (d) mol % which shows a compound (C) in the 1st table at this time. Then, the vacuum tub was again returned to atmospheric pressure, 1g of magnesium ribbons was put into the resistance heating boat made from molybdenum, 500mg of silver wires was put into the tungsten basket, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal.
[0110]
[Table 1]

第 1 表

	(A) 化合物の種類	(b) (A) の含有量 (モル%)	(C) 化合物の種類	(d) (C) の含有量 (モル%)
実施例 1	PAVBi	3.0	ルブレン*	0.5
実施例 2	PAVTP	3.0	ルブレン	0.5
実施例 3	PAVBi	3.0	ルモルゲンF	3.0

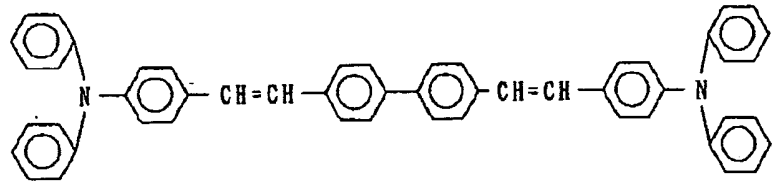
＊：アルドリッチ社製

[0111] In addition, the fluorescence peak wavelengths of each organic compound were DPVBi (solid-state):465nm, PAVBi(solid-state):463nm, PAVTP(solid-state):454nm, Alq(solid-state):500nm, rubrene (0.1 % of the weight solution of dimethylformamides):585nm, and F (0.1 % of the weight solution of dimethylformamides):595nm of RUMOGEN. Moreover, the structure expression of PAVBi and PAVTP is shown below.

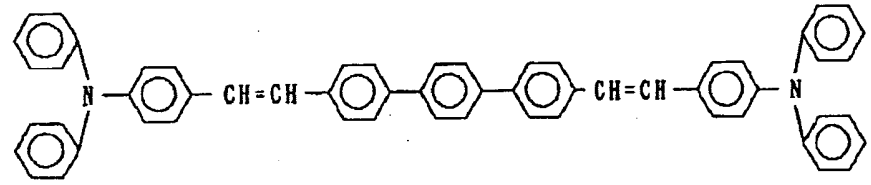
[0112]

[Formula 55]

PAVBi



PAVTP



[0113] The central value and the reduction-by-half life of an initial performance of this element were searched for. The result is shown in the 2nd table. In addition, the reduction-by-half life measured on condition that initial brightness:100 cd/m2, a direct-current constant-current drive, and drive environmental:dryness nitrogen-gas-atmosphere mind, and was expressed in time which amounted to one half of initial brightness.

[0114] The same washing process as the glass substrate with ITO of the same configuration as example 4 examples 1-3 was given, and it considered as the transparent-electrode substrate, and installed in the substrate electrode holder of a vacuum tub. 200mg of TPD(s) was put into the resistance heating boat made from molybdenum, rubrene was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, the boat containing TPD was heated, the vacuum evaporationo of the TPD was carried out on the transparent support substrate by the 29-30nm [/second] evaporation rate, and the hole-injection transporting bed of 60nm of thickness was produced. the boat containing this, simultaneously rubrene -- heating -- 0.5-

mol % -- it came out comparatively and the hole-injection transporting bed was made to contain rubrene The substrate temperature at this time was a room temperature. Then, it returned to atmospheric pressure at once, 200mg of DPVBi(s) was put into another resistance heating boat made from molybdenum, Compound PAVBi was put into still more nearly another boat made from molybdenum, the vacuum tub was decompressed up to 1x10 to 4 Pa, and 40nm laminating of the DPVBi was carried out as the first luminous layer on this hole-injection transporting bed. The boat containing PAVBi was heated simultaneously and this first luminous layer was made to contain PAVBi at three-mol % of a rate. Then, it returned to atmospheric pressure, 200mg of Alq(s) was newly put into the resistance heating boat made from molybdenum, 1g of magnesium ribbons was put into the resistance heating boat made from molybdenum, 500mg of silver wires was further put into the tungsten basket, the vacuum tub was decompressed up to 1x10 to 4 Pa, and 40nm produced the film by making Alq into the second luminous layer. Then, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal. The central value and the reduction-by-half life of an initial performance of this element were searched for like examples 1-3. The result is shown in the 2nd table.

[0115] The same washing process as the glass substrate with ITO of the same configuration as example 5 examples 1-3 was given, and it considered as the transparent-electrode substrate, and installed in the substrate electrode holder of a vacuum tub. 200mg of TPD(s) was put into the resistance heating boat made from molybdenum, 200mg of DPVBi(s) was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was decompressed up to 1x10 to 4 Pa. Then, the boat containing TPD was heated at 215-220 degrees C, the vacuum evaporationo of the TPD was carried out on the transparent support substrate by the 0.1-0.3nm [/second] evaporation rate, and the hole-injection transporting bed of 60nm of thickness was made to produce. The substrate temperature at this time was a room temperature. Without taking this out from a vacuum tub, the boat by which DPVBi entered on the hole-injection transporting bed was heated at 245 degrees C, and 40nm laminating deposition was carried out as the first luminous layer. Then, the vacuum tub was returned to atmospheric pressure, 200mg of Alq(s) was newly put into the resistance heating boat made from molybdenum, RUMOGEN F red (product made from BAFUSU) was put into still more nearly another resistance heating boat made from molybdenum, and the vacuum tub was again decompressed up to 1x10 to 4 Pa. Subsequently, the resistance heating boat made from molybdenum containing RUMOGEN F red was heated at 330 degrees C, the boat made from molybdenum containing Alq was heated to 250 degrees C, and the 40nm of the second luminous layer was produced so that the content of RUMOGEN F red might become three-mol% to Alq. Then, the vacuum tub was decompressed up to 1x10 to 4 Pa after that by returning a vacuum tub to atmospheric pressure, putting 1g of magnesium into the resistance heating boat made from molybdenum, and putting 500mg of silver wires into the basket made from a tungsten, magnesium was carried out by the 1.4nm [/second] evaporation rate, 150nm simultaneous vacuum evaporationo of the silver of thickness was carried out by the 0.1nm [/second] evaporation rate, and it considered as the cathode which consists of a mixed metal. The central value and the reduction-by-half life of an initial performance of this element were searched for like examples 1-3. The result is shown in the 2nd table.

[0116]

[Table 2]

第　2　表－1

	初　期　性　能			
	電　圧 (V)	電流密度 (mA/cm^2)	発光輝度 (cd/m^2)	発光効率 (ルーメン/W)
実施例1	9.5	4.5	100	0.7
実施例2	9.5	5.0	100	0.7
実施例3	10.0	7.0	100	0.4
実施例4	11.0	6.5	100	0.4
実施例5	9.8	7.5	100	0.4

[0117]
[Table 3]

第　2　表－2

	ＣＩＢ色度座標 (x, y)	半減時間 (時間)
実施例1	(0.245, 0.278)	1,000
実施例2	(0.245, 0.267)	800
実施例3	(0.300, 0.320)	600
実施例4	(0.265, 0.278)	300
実施例5	(0.220, 0.240)	200

[0118] As shown in the 2nd table, compared with an example 5, the whitening and quantum yield (equivalent to brightness/current density) of examples 1-4 of the luminescent color are improving, and its luminescence stability is also improving.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is a graph showing the definition field of the white light in a CIE chromaticity coordinate.

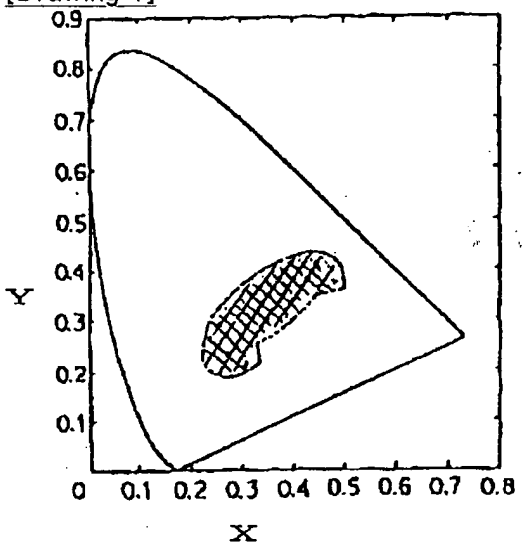
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



▨：ＣＩＥ座標における白色発光領域を示す。

[Translation done.]